SFUND-2001-0009-0008

HAZARD RANKING SYSTEM DOCUMENTATION RECORD
FRANKLIN SLAG PILE (MDC) SITE
PHILADELPHIA COUNTY, PENNSYLVANIA

Prepared For:

U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103

Prepared By:

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107 Chelsea Parkway
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EPA Contract No. 68-S3-00-02
Technical Directive Document 03-00-09-010
DTN: 1042C

August 9, 2001

HRS DOCUMENTATION RECORD

Site Name: Franklin Slag Pile (MDC)

Contact Persons:

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Pathways, Components, or Threats Not Scored

The Hazard Ranking System (HRS) evaluation performed for the Franklin Slag Pile is for the surface water migration and air migration pathways. The ground water migration and soil exposure pathways were not evaluated because their contribution to the overall score of the site is minimal.

HRS DOCUMENTATION RECORD

Site Name: Franklin Slag Pile (MDC)

EPA Region: 3

Date Prepared: **February 15, 2001**
Date Revised: **March 22, 2001**
Date Revised: **July 24, 2001**
Date Revised: **August 9, 2001**

Street Address of Site: 3110 Castor Avenue

County and State: Philadelphia County, Pennsylvania

General Location in the State: Southeastern Pennsylvania (Figure 1)

Topographic Maps: U.S. Geologic Survey, Camden, NJ-PA, 1995

Latitude: 39E58N59.50 N (Ref. 3)

Longitude: 75E05N2.00 W (Ref. 3)

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from HRS Table 3-1, Line 13)	NS[a]	NS
2a.	Surface Water Overland/Flood Migration Component (from HRS Table 4-1, Line 30)	8.91	79.39
2b.	Ground Water to Surface Water Migration Component (from HRS Table 4-25, Line 28)	NS	NS
2c.	Surface Water Migration Pathway Score (S_{sw}) (Enter the larger of the two scores from Lines 2a and 2b as the pathway score).	8.91	79.39
3.	Soil Exposure Pathway Score (S_s) (from HRS Table 5-1, Line 22)	NS	NS
4.	Air Migration Pathway Score (S_a) (from HRS Table 6-1, Line 12)	100	10,000
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		10,079.39
6.	**HRS Site Score** Divide the value on Line 5 by 4 and take the square root		50.20

Note:

[a] NS = Not scored

FRANKLIN SLAG PILE
SURFACE-WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

	Factor Categories and Factors	Maximum Value	Value Assigned
	Drinking Water Threat		
	Likelihood of Release		
1.	Observed Release	550	0
2.	Potential to Release by Overland Flow		
	2a. Containment	10	10
	2b. Runoff	25	1
	2c. Distance to Surface Water	25	9
	2d. Potential to Release by Overland Flow [lines 2a x (2b + 2c)]	500	100
3.	Potential to Release by Flood		
	3a. Containment (Flood)	10	10
	3b. Flood Frequency	50	25
	3c. Potential to Release by Flood [lines 3a x 3b]	500	250
4.	Potential to Release [lines 2d + 3c]	500	350
5.	Likelihood of Release [higher of lines 1 and 4]	550	350
	Waste Characteristics		
6.	Toxicity/Persistence	a	10,000
7.	Hazardous Waste Quantity	a	10,000
8.	Waste Characteristics	100	100
	Targets		
9.	Nearest Intake	50	0
10.	Population		
	10a. Level I Concentrations	b	0
	10b. Level II Concentrations	b	0
	10c. Potential Contamination	b	16
	10d. Population [lines 10a + 10b + 10c]	b	16
11.	Resources	5	5
12.	Targets [lines 9 + 10d + 11]	b	21
	Drinking Water Threat Score		
13.	Drinking Water Threat Score [lines 5 x 8 x 12)/82,500][c]	100	8.91

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] Do not round to nearest integer
NS Not scored

SURFACE-WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET (Cont.)

Factor Categories and Factors	Maximum Value	Value Assigned
Human Food Chain Threat		
Likelihood of Release		
14. Likelihood of Release [same value as line 5]	550	350
Waste Characteristics		
15. Toxicity/Persistence/Bioaccumulation	a	5×10^{7}
16. Hazardous Waste Quantity	a	10,000
17. Waste Characteristics	1,000	560
Targets		
18. Food Chain Individual	50	0
19. Population		
19a. Level I Concentrations	b	0
19b. Level II Concentrations	b	0
19c. Potential Contamination	b	$3.0E^{-7}$
19d. Population [lines 19a + 19b + 19c]	b	0.0000003
20. Targets [lines 18 + 19d]	b	0.0000003
Human Food Chain Threat Score		
21. Human Food Chain Threat Score [lines 14 x 17 x 20)/82,500][c]	100	0.00

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] Do not round to nearest integer
NS Not scored

SURFACE-WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET (Cont.)

Factor Categories and Factors	Maximum Value	Value Assigned
Environmental Threat		
Likelihood of Release		
22. Likelihood of Release [same value as line 5]	550	350
Waste Characteristics		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	a	5×10^6
24. Hazardous Waste Quantity	a	10,000
25. Waste Characteristics	1,000	320
Targets		
26. Sensitive Environments		
26a. Level I Concentrations	b	0
26b. Level II Concentrations	b	0
26c. Potential Contamination	b	0.00805
27. Targets [lines 26a + 26b + 26c]	b	0.00805
Environmental Threat Score		
28. Environmental Threat Score [lines 22 x 25 x 27)/82,500][c]	60	0
Surface-Water Overland/Flood Migration Component Score for a Watershed		
29. Watershed Score [lines 13 + 21 + 28][c]	100	8.91
SURFACE-WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE		
30. Component Score (S_{of})[c] [highest score from line 29 for all watersheds evaluated][c]	100	8.91

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] Do not round to nearest integer
NS Not scored

FRANKLIN SLAG PILE
AIR MIGRATION PATHWAY SCORESHEET

	Factor Categories and Factors		Maximum Value		Value Assigned
	Likelihood of Release				
1.	Observed Release		550		550
2.	Potential to Release				
	2a. Gas Potential to Release	500		NS	
	2b. Particulate Potential to Release	500		NS	
	2c. Potential to Release (higher of lines 2a and 2b)		500		NS
3.	Likelihood of Release (higher of lines 1 and 2c)		550		550
	Waste Characteristics				
4.	Toxicity/Mobility		a		200
5.	Hazardous Waste Quantity	a		10,000	
6.	Waste Characteristics		100		32
	Targets				
7.	Nearest Individual	50		50	
8.	Population				
	8a. Level I Concentrations	b		4,630	
	8b. Level II Concentrations		b		0
	8c. Potential Contamination	b		96	
	8d. Population [lines 8a + 8b + 8c]	b		4,726	
9.	Resources		5		0
10.	Sensitive Environments				
	10a. Actual Contamination		c		330
	10b. Potential Contamination	c		0	
	10c. Sensitive Environments (lines 10a + 10 b)		c		330
11.	Targets (lines 7 + 8d + 9 + 10c)		b		5,056
	Air Migration Pathway Score				
12.	Pathway Score (S_a) [(lines 3 × 6 × 11)/82,500][d]		100		100

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] No specific maximum value applies to factor. However, pathway score based solely on sensitive environments is limited to maximum of 60.
[d] Do not round to nearest integer
NS Not scored

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6.	Hagedorn, James. Franklin Smelting and Refining Status. December 4, 1997. (2 pages).
7.	Frank, Bob. Franklin Slag Pile Truck Weight Log. April 11, 2000. (1 page).
8.	Frank, Bob. Franklin Slag Pile Transportation and Disposal Log. April 11, 2000. (1 page).
9.	Waste Management, Inc., and New York Department of Environmental Conservation. Certificates of Disposal and Hazardous Waste Manifests for Manifest Numbers NYB9353088, NYB9353079, NYB9353061, NYB9353052, NYB9353043, NYB9353034, NYB9353025, NYB9353016, NYB9353007, NYB9352998, NYB9352989, NYB9352971, NYB9352962, NYB9352953, NYB9352944, NYB9352935, NYB9352926, NYB9352899, NYB9352908, and NYB9352917. April 13 (for certificates of disposal) and April 11, 2000 (for manifests). (61 pages).
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15.	EPA. Memorandum Regarding Request for Ceiling Increase and an Exemption to the 12-Month and $2 Million Statutory Limit for a CERCLA Removal Action Franklin Slag Pile (MDC) Site Philadelphia, Philadelphia County, Pennsylvania. From Douglas Fox, On-Scene Coordinator, EPA Removal Response Section. To Abraham Ferdas, EPA, Director, Hazardous Site Cleanup Division. February 2, 2000. (14 pages).
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17.	EPA. Memorandum Regarding Trip Report - Franklin Smelting Company and MDC, Inc., Philadelphia, Pennsylvania. From Greg Koltonuk and Douglas Donor, RCRA Enforcement General Section. To Victoria P. Binetti, Chief, RCRA Enforcement General Section. March 3, 1989. (4 pages).
18.	Elkins, Bruce. Abbreviated Sampling Plan for Emergency Response for the Franklin Slag Pile (MDC) Site. March 2, 2000. (3 pages).
19.	Lockheed Martin Environmental Services. Memorandum Regarding Inorganic Data Validation (IM1 Level) for Case: 28250, SDG: MCWY80, Site: Franklin Slag Pile (MDC). From Reginal Howard, Inorganic Data Reviewer. To Fredrick Foreman, ESAT Regional Project Officer. July 13, 2000. (55 pages).
20.	Lockheed Martin Environmental Services. Memorandum Regarding Notification of Samples Exceeding The TCLP Regulatory Chemical Health Advisory Limits. From Kenneth W. Curry, Senior Data Reviewer. To Doug Fox, Regional Project Manger, EPA. February 15, 2000. (47 pages).
21.	Sentinel, Inc. Memorandum Regarding Request for Waiver SDG MCYJ34. Case 27709. From Beverly A. Kilgore, Quality Assurance Officer. To Mr. Edward Messer, EPA APO/TPO. January 14, 2000. (42 pages).
22.	Author Not Provided. Franklin Slag Pile. TDD 001-132. Soil/Slag Sampling Analytical Summary. Undated. (4 pages).
23.	U.S. Geological Survey. Topographic Map for Camden, Pennsylvania-New Jersey. 7.5-Minute Series. 1995. (1 sheet).

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25.	Commonwealth of Pennsylvania. Pennsylvania Code. Title 25. Environmental Resources. Department of Environmental Resources. Chapter 93, Water Quality Standards. Current through 24 Pa.B. 2372. April 30, 1992. (5 pages).
26.	EPA. Draft Final Report of Philadelphia IEMP. Pages V-29 - V-40. Undated. (12 pages).
27.	Tetra Tech. Record of Telephone Conversation. From Alicia Shultz, Project Manager. William Wankoff, Engineer, Philadelphia Department of Water - Baxter Treatment Plant. November 9, 2000. (1 page).
28.	NUS Corporation. Site Inspection of Philadelphia Sludge Lagoons. March 21, 1990. Sections 1 - 5.3, Portions of Section 7, and Form I for MCAR52. (69 pages).
29.	Hastings, Robert; O'Herron, John; Schick, Kevin; and Lazzari, Mark. *Estuaries*. Occurrence and Distribution of Shortnose Sturgeon, *Acipenser brevirostrum*, in the Upper Tidal Delaware River. Volume 10, No. 4, pp. 337 - 341. December 1987. (5 pages).
30.	EPA. Findings of Violation and Order for Compliance. Docket No. III-99-025-DN. In the Matter of MDC Industries, Inc. September 13, 1999. (5 pages).
31.	EPA. Proceedings to Assess Class II Administrative Penalty Under Section 309(g) of the Clean Water Act. Docket Nos. CWA-3-99-0033. In The Matter of MDC Industries, Inc. Undated. (2 pages).
32.	Raytheon Engineers and Constructors. Raytheon Environmental Services Laboratories Report for Satterthwaite Associates for MDC Industries, Inc. Outfall No. 1, Sample No. 1C. August 11, 1994. (22 pages).
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35.	Philip Analytical Services. Letter Regarding MDC, Project 178733. From Fred Usbeck, Certified Industrial Hygienist, Director, Laboratory Services. To Lisa Pacera, EPA. 1999. (3 pages).
36.	U.S. Geological Survey. Delaware River Basin Stations. November 5, 2000. http://pa.water.usgs.gov/. (2 pages).
37.	Weston. Air Monitoring/Sampling Plan. Franklin Slag Pile (MDC), Philadelphia, Philadelphia County, Pennsylvania. January 4, 2000. (8 pages).
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39.	Weston. Air Sample Data. Franklin Slag Pile (MDC). January 17, 2000. (4 pages).
40.	Tetra Tech. Record of Telephone Conversation Regarding Philadelphia Water Department Worker Population. From Alicia Shultz, Project Manager. To Maxseen Miluzzo, Administrative Assistant, Philadelphia Water Department (PWD). November 7, 2000. (1 page).
41.	Tetra Tech. Record of Telephone Conversation. From Alicia Shultz, Project Manager. To Jim McLaughlin, Supervisor, Philadelphia Gas Works (PGW). November 7, 2000. (1 page).
42.	Tetra Tech. Record of Telephone Conversation. From Alicia Shultz, Project Manager. To Chris Casy, Container Terminal Manager, Tioga Marine Terminal. November 7, 2000. (1 page).
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45.	Syracuse Research Corporation. Toxicological Profile for Beryllium. April 1993. (7 pages).
46.	Tetra Tech EM Inc. Technical Memorandum for the Franklin Slag Pile Site. November 1, 2000. (27 pages).

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49.	EPA. Aerometric Information Retrieval System. Air Quality Subsystem. Raw Data Report - 24-Hour Time Period. Castor and Delaware Avenues. November 16, 2000. (8 pages).
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51.	National Oceanic Atmospheric Administration, National Climatic Data Center. Surface Weather Data. Philadelphia, Pennsylvania International Airport. WBAN: 13739. October 1997 - March 1999. (19 pages).
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60.	PA DER. Interoffice Memorandum Regarding Site Visit for Franklin Smelting and Refining. From David Burke. October 10, 1995. (4 pages).
61.	Pennsylvania Department of Environmental Protection (PADEP). Letter Regarding Hazardous Waste Violations for MDC Industries. From Chris Smolar, Waste Management Specialist, Waste Management Program. To Joe Carroll, MDC Industries. October 4, 1999. (3 pages).
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Reference Number	Description of the Reference
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SITE SUMMARY

The Franklin Slag Pile (MDC) site (FSP) is located in the Port Richmond section of northeast Philadelphia, Pennsylvania (Figure 1). A pile of copper slag is located on the FSP site. The slag pile's volume is approximately 68,000 cubic yards (yd^3). The slag was generated as a by-product from copper smelting conducted at the adjacent Franklin Smelting and Refining Corporation (FSRC) (Ref. 4, p. 1). FSRC processes produced a 70% grade copper which yielded a by-product called mineral grit. This mineral grit was sold to MDC Industries (MDC) and stored in the slag pile. MDC physically treated the grit and sold the grit in 50-pound bags and by the truckload for use as a sand-blasting material and in asphalt roofing (Refs. 17, p. 1; 4, p. 1; 63, p. 1). MDC ceased operations and abandoned the site on December 30, 1999 (Ref. 4, p. 1).

MDC was not an operational Resource Conservation and Recovery Act (RCRA) generator or facility; it does not have an U.S. Environmental Protection Agency (EPA) identification number (Refs. 17, p. 4; 66, p. 6; 71, p. 1 and 2). MDC was exempt from RCRA due to the recycling exemption (Refs. 17, p. 4; 70, p. 1).

The slag pile is bordered by a CONRAIL rail spur and the Philadelphia Water Department (PWD) Northeast Water Treatment Plant to the north and east, Delaware Avenue and Tioga Marine Terminal to the southeast, Castor Avenue and portions of the former FSRC site, the Philadelphia Gas Works (PGW) to the southwest, and FSRC to the northwest (Figure 2). The Delaware River is less than 1/4 mile to the southeast (Refs. 4, p. 1; 23). No residents are located within 1/4 mile of the slag pile (Ref. 5, pp. 3 and 4).

While MDC operated, material from the slag pile was observed to have migrated off the property on all four sides of the slag pile. The entire sidewalk area between MDC and Delaware Avenue was covered in black slag material. Black slag also covered an inactive rail line bordering the Tioga Marine Terminal on the north side. Storm drains along Castor and Delaware Avenues, which empty directly into the Delaware River, were caked with slag that had washed off the property. Slag was observed to cover a wetland area on the PWD property. Slag was observed being carried by the wind off the property (Ref. 15, pp. 2 and 12). Tioga Marine Terminal employees complained of slag material in their beverages (Ref. 5, p. 2).

MDC was cited by EPA Region III Water Protection Division (WPD) for releasing lead in storm water run-off that was captured by storm drains that discharged into the Delaware River (Ref. 15, p. 10).

Samples of the slag revealed leachable concentrations of lead up to 36,900 micrograms per liter (Fg/L) and concentrations of lead up to 9,060 milligrams per kilogram (mg/kg) (Ref. 4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-18 and Attachment 2, pp. A-2-3 and A-2-4). In January 2000, an emergency response action was initiated to contain the slag pile. The action included capping the slag pile in place; decontaminating and removing equipment stored in the slag pile; removing slag that had spilled off the property onto sidewalks, roads, and adjacent properties; removing visible slag from the wetland adjacent to the northeastern side of the slag pile; excavating slag and contaminated soil from the active and inactive railroads located southeast and northwest of the slag pile; and cleaning slag from adjacent storm drains (Refs. 5, p. 2; 52, pp. 8, 9, 13 - 28). All of the slag was not removed from the surrounding properties (Ref. 5, pp. 1 and 4; 52, pp. 19, 24, 25, and 26).

Air samples collected during the emergency response actions revealed an observed release of beryllium, copper, and lead to air, as documented in Section 6.1.1. While MDC operated, MDC was cited for releasing lead into the air at concentrations exceeding ambient air standards (Ref. 4, p. 3).

A copy of the *Figure 1* is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

A copy of the *Figure 2* is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

SITE SUMMARY (CONCLUDED)

Surface-water runoff from the slag pile was not contained. Runoff from the slag pile flows to storm sewers which discharge to the Delaware River (Ref. 5, pp. 1 and 4; 60, p. 1). Targets associated with the Delaware River include wetlands, migratory fish, state protected water for aquatic species, and Federally threatened and endangered species (Refs. 25, pp. 93-6, 93-7, 93-45, 93-48, and 93-49; 29, pp. 337 and 340; 28, p. 3-9). Targets associated with the air migration pathway include a worker population (Refs. 5, Figure 1, p. 3; 24).

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 1

HRS Source Type: Pile

Source Description: Slag Pile

Source 1 is a copper smelting by-product slag pile located on a 165,000 square foot lot. The slag pile is currently approximately 68,000 cubic yards (yd^3) in volume and was generated as a by-product from copper smelting conducted at the adjacent FSRC (Ref. 4, p. 1). FSRC processes produced a 70% grade copper and a 99% grade copper. The process that yielded a 70% grade copper also produced mineral grit. The mineral grit was sold to MDC and stored in the slag pile. MDC physically treated the grit producing a shot-blasting material. Samples of the grit tested by FSRC were found to be extraction procedure (EP) toxic for lead (Ref. 17, p. 1). MDC sold the grit in 50-pound bags and by the truckload for 40 years as sand blasting material and for use in asphalt roofing (Refs. 4, p. 1; 63, p. 1). MDC ceased operations and abandoned the property on December 30, 1999 (Ref. 4, p. 1). FSRC ceased operations in September 1997 (Ref. 6, p. 1).

The slag pile (grit) was owned by FSRC. FSRC leased the property that the slag was stored on and MDC used the property to crush, dry, and size smelter slag and sell the grit for sandblasting material and for use in asphalt roofing (Ref. 15, p. 2; 63, p. 1). Francos Realty, Inc. owns the property that the slag pile is located on (Ref. 52, p. 10).

On February 9, 1988, the Pennsylvania Department of Environmental Protection (PADEP) conducted a sampling event at the PWD property adjacent to the slag pile (Ref. 4, p. 1). One of the samples contained a black gritty sand solid. The sample was analyzed for extraction procedure (EP) toxic metals (Ref. 4, p. 1 and Attachment 1, p. A-1-1). The sample contained lead at a concentration of 12,300 parts per billion (ppb) (Ref. 4, Attachment 1, p. A-1-2).

On April 3, 1995, PADEP collected five samples from the slag pile. The samples were analyzed for toxicity characteristics leachate procedures (TCLP) metals and total metals. All lead concentrations in the samples exceeded the Resource Conservation and Recovery Act (RCRA) TCLP regulatory level for lead of 5 milligrams per liter (mg/L) (Ref. 4, pp. 1 and 3 and Attachment 2, pp. A-2-2, A-2-4, A-2-6, A-2-8, A-2-10, A-2-12, A-2-13, A-2-14, A-2-15, and A-2-16). The lead concentrations in the five samples ranged from 5.76 mg/L to 86.60 mg/L (Ref. 4, Attachmemt 2, pp. A-2-2, A-2-4, A-2-6, A-2-8, and A-2-10).

On June 11, 1998, EPA Region III conducted a RCRA sampling inspection of the slag pile. Ten composite samples were collected from the slag pile, and four grab samples were collected of the bagged “polygrit” material. Every sample contained concentrations of lead that exceeded the RCRA TCLP regulatory limit of 5 mg/L (Ref. 4, p. 3 and Attachment 3, pp. A-3-7, A-3-8, and A-3-13 - A-3-20). The lead concentrations from the 14 samples ranged from 5.50 mg/L to 36.9 mg/L (Ref. 4, Attachment 3, p. A-3-17 - A-3-20).

On August 31, 1999, PADEP collected five samples of the slag pile. The samples were analyzed for both metals and TCLP metals. All concentrations of lead in the samples exceeded the TCLP regulatory limit for lead. Total lead ranged from 4,861 to 8,150 parts per million (ppm) (Ref. 4, p. 3 and Attachment 4, pp. A-4-1 - A-4-5).

On January 4, 2000, a visual inspection of the slag pile was conducted. The following observations were made:

- Approximately 75 percent of the 3-acre property was occupied by an uncovered slag pile, estimated to be 35 feet in height. Wind and stormwater runoff erosion channels were observed throughout the pile (Ref. 15, p. 2).

- Slag was observed to have migrated beyond the property borders on all sides. The entire sidewalk area between the slag pile and Delaware Avenue was covered with black slag. The inactive railroad bordering the Tioga Marine Terminal on the south side of Delaware Avenue contained a significant amount of black slag. The sidewalk area between the slag pile and Castor Avenue contained black slag. Storm drains along Castor and Delaware Avenues, which empty directly into the Delaware River, were caked with material that had washed off the slag pile. Slag was observed in a wetland located on the PWD Northeast Treatment Facility (Ref. 15, pp. 2 and 12).

On January 5, 2000, EPA collected 10 slag-sediment samples from the pile for analysis for target analyte list (TAL) and TCLP metals. Six samples were collected from around the slag pile to document migration of contaminants from the slag pile. One sample was collected from the bagged product (Ref. 4, p. 4). All the samples contained slag (grit) from the slag pile (Ref. 4, p. 5). The total lead concentration in samples from the slag pile and surrounding area ranged from 4,220 to 6,370 ppm. The product sample (SP-04) contained a lead concentration of 22,100 ppm (Ref. 4, p. 5). The beryllium concentration in samples from the slag and surrounding area ranged from 93 to 129 ppm. The product sample contained a beryllium concentration of 86.1 mg/kg. The copper concentration in samples of the slag and surrounding area ranged from 13,200 to 16,600 mg/kg. The product sample contained a copper concentration of 46,400 mg/kg (Ref. 4, p. 5 and Attachment 6). Slag was observed to have migrated from the slag pile on all four sides during the sampling event. Slag was observed on the sidewalks and caked onto the sides of the storm drains on Castor and Delaware Avenues. Slag had overrun the steel fence between slag pile and PWD properties at several locations. The fence surrounding the slag pile was knocked down in numerous places. Part of the fence between the slag pile and the active railroad track had been knocked down, allowing slag to spill onto the railroad track (Refs. 4, p. 3; 5, p. 1).

In March and April 2000, four soil-slag samples were collected from four corners of the property on which the slag pile was located at a depth of 3 feet. A fifth sample of the slag was collected from the western side of the pile (Ref. 22, p. 1). The soil-slag samples contained lead concentrations of 6,660; 257; 2,450; and 1,290 ppm and beryllium concentrations of 52.3; 1.9; 93.1; and 102 ppm (Refs. 22, pp. 2 and 3; 20, pp. 7, 8, and 10 - 23). The slag sample contained a lead concentration of 3,170 ppm and beryllium concentration of 110 ppm (Ref. 22, p. 4).

On June 27, 2000, 20 surface soil samples were collected for analysis for total metals from an inactive railroad track that parallels Delaware Avenue to the southeast of the slag pile (Refs. 18, p. 2; 19, pp. 1 and Appendix C, pp. C- 21 and C-20, Appendix D, pp. D-1 and D-2). The concentrations of lead detected in the soil samples ranged from 475 to 5,170 mg/kg (Ref. 19, Appendix C, pp. C-1 - C-20, Appendix D, pp. D-1 and D-2).

An emergency response action was initiated in January 1999 and was completed in October 2000 (Ref. 52, p. *iii*). The action included capping the slag pile in place; decontaminating and removing equipment stored in the slag pile area; removing slag that had spilled off-site onto sidewalks, roads, and adjacent properties; removing slag from the wetland adjacent to the northeastern side of the slag pile; excavating slag and contaminated soil from the active and inactive railroads located southeast and northwest of the slag pile; and cleaning slag from adjacent storm drains (Refs. 5, p. 2; 52, pp. 8, 9, 13 - 28).

The response action included off-site disposal of 78 tons of lead-contaminated hazardous waste from excavated soil and slag on March 31, 2000 (Refs. 10; 11; 12, pp. 1 - 6); 487 tons of lead hazardous waste from the slag pile on April 11, 2000 (Refs. 7; 8; 9, pp. 1 - 61); and 246 tons of hazardous debris between June and September 2000 (Refs. 16, pp. 1 and 2; 9, pp. 1 - 61). The slag pile and other waste were 110,000 yd^3 in size before the response action (Ref. 15, p. 2).

For the 68,000 yd^3 of slag remaining on the property, the response action does not qualify as a removal for Hazard Ranking System (HRS) purposes because the slag was not removed from the property; it was capped in place (Ref. 13, p. 1). Additionally, not all of the potential threats to human health and the environment have been removed from the site (Ref. 14, p. 2). Slag or grit remains in the wetland located on the northeastern side of the slag pile and in soil along the active railroad track and has been observed on the Tioga Marine Terminal property (Ref. 5, pp. 1 and 4; 52, pp. 19, 24, 25, and 26).

During the response action, airborne releases of slag were observed when winds exceeded 5 miles per hour (mph). Winds between 10 and 15 mph were observed carrying large black dust clouds of material from the slag pile to the northeast (Ref. 15, p. 2).

Source Location:

The slag pile is located in Philadelphia, Pennsylvania, on the northeastern corner of Castor and Delaware Avenues (Figures 1 and 2).

Containment:

Release to Ground Water: The ground water pathway was not evaluated.

Release via overland migration and/or flood: The containment factor value for the surface-water migration pathway is evaluated for the source prior to capping the pile or prior to the removal actions because wastes remain on the site. The removal actions included the implementation of temporary surface water drainage controls and a temporary covering of the slag pile (Ref. 15, pp. 1 and 6). Surface-water runoff from the slag pile flowed to a wetland located on the northeast side of the slag pile or to storm sewers located along Castor and Delaware Avenues. The storm sewers discharge to the Delaware River and the wetland discharge to the PWD Northeast Treatment Plant (Ref. 5, pp. 1 and 4; 60, p. 1; 72, pp. 1 and 2). The slag pile was not covered while it was in operation (Ref. 15, p. 1). There is no documentation of a maintained engineered cover or functioning and maintained run-on control system and runoff management system; therefore, a containment factor of 10 was assigned (Refs. 1, Table 4-2; 5, pp. 1 and 4; 59, p. 2; 60, pp. 1 and 2; 61, p. 2; 62, pp. 1 and 2; 63, p. 2).

Gas Release to Air: The containment factor value for the air migration pathway is evaluated for the source prior to capping the pile or prior to the removal actions because wastes remain on the site. The removal actions included the implementation of a temporary covering of the slag pile (Ref. 15, pp. 1 and 6). The slag pile was not covered while it was in operation (Ref. 15, p. 1). Therefore, a containment factor of 10 was assigned (Ref. 1, Table 6-3).

Particulate Release to Air: The containment factor value for the air migration pathway is evaluated for the source prior to capping the pile or prior to the removal actions because wastes remain on the site. The removal actions included the implementation of a temporary covering of the slag pile (Ref. 15, pp. 1 and 6). The slag pile was not covered while it was in operation (Ref. 15, p. 1). Therefore, a containment factor of 10 was assigned (Ref. 1, Table 6-9).

2.4.1 Hazardous Substances

On numerous occasions samples of slag were collected from the slag pile. A summary of the concentrations of copper, beryllium, and lead detected in the samples of the slag pile are provided in the table below. Concentrations reported in Fg/L or mg/L indicate that the analyte was analyzed by an EP or TCLP method. An EP method analyzes an extract from the sample. The concentration reported as mg/kg is the total beryllium, copper, or lead detected in the sample. Other hazardous substances were detected in waste samples; however, beryllium, copper, and lead are the major constituents of concern.

TABLE 1
CONCENTRATIONS OF BERYLLIUM, COPPER, AND LEAD DETECTED IN SAMPLES OF SLAG

Evidence	Sample ID	Hazardous Substance	Conc.	DL	Unit	Reference
Slag	2135266	Lead	12,300 (EP)	200	Fg/L	4, Attachment 1, pp. A-1-1, A-1-2, and A-1-7
	2150004	Lead (Total)	5,480 (Digestion)	NA	mg/kg	4, Attachment 2, pp. A-2-1 and A-2-2
	2150004	Lead	6.52 (TCLP)	NA	mg/L	4, Attachment 2, pp. A-2-1 and A-2-2
	2150005	Lead (Total)	9,060 (Digestion)	NA	mg/kg	4, Attachment 2, pp. A-2-3 and A-2-4
	2150005	Lead	5.76 (TCLP)	NA	mg/L	4, Attachment 2, pp. A-2-3 and A-2-4
	2150003	Lead (Total)	5,010 (Digestion)	NA	mg/kg	4, Attachment 2, pp. A-2-9 and A-2-10
	2150003	Lead	11.7 (TCLP)	NA	mg/L	4, Attachment 2, pp. A-2-9 and A-2-10
Polygrit or Slag	Polygrit No. 1 98061207	Lead	4,930 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-17
	Polygrit No. 1 98061207	Lead	8,920 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-17
	Polygrit No. 2 98061208	Lead	3,140 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-17

TABLE 1
CONCENTRATIONS OF BERYLLIUM, COPPER, AND LEAD DETECTED IN SAMPLES OF SLAG

Evidence	Sample ID	Hazardous Substance	Conc.	DL	Unit	Reference
Polygrit or Slag	Polygrit No. 2 98061208	Lead	6,160 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-17
	Polygrit No. 3 98061211	Lead	5,510 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-17
	Polygrit No. 3 98061211	Lead	5,400 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-18
	Polygrit No. 4 98061218	Lead	4,730 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-19
	Polygrit No. 4 98061218	Lead	6,150 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-19
Slag	Cell 41-45 98061209	Lead	24,900 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-17
	Cell 41-45 98061209	Lead	30,500 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-17
	Cell 41-45 98061210	Lead	26,700 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-17
	Cell 41-45 98061210	Lead	34,700 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-18
	Cell 1-5 98061212	Lead	30,000 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-17
	Cell 1-5 98061212	Lead	36,900 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-7, A-3-13, and A-3-18
	Cell 6-10 98061213	Lead	19,100 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-17
	Cell 6-10 98061213	Lead	25,500 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-18

TABLE 1
CONCENTRATIONS OF BERYLLIUM, COPPER, AND LEAD DETECTED IN SAMPLES OF SLAG

Evidence	Sample ID	Hazardous Substance	Conc.	DL	Unit	Reference
Slag	Cell 11-15 98061214	Lead	16,500 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-18
	Cell 11-15 98061214	Lead	19,700 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-18
	Cell 16-20 98061215	Lead	11,500 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-18
	Cell 16-20 98061215	Lead	15,600 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-18
	Cell 36-40 98061217	Lead	29,200 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-18
	Cell 36-40 98061217	Lead	30,800 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-18
	Cell 21, 22, 26, 27, 31, 32 98061219	Lead	27,700 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-19
	Cell 21, 22, 26, 27, 31, 32 98061219	Lead	32,200 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-19
	Cell 23, 25, 28, 30, 35 98061220	Lead	12,300 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-19
	Cell 23, 25, 28, 30, 35 98061220	Lead	13,200 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-19
	Cell 46-50 98061221	Lead	5,680 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-19
	Cell 46-50 98061221	Lead	11,300 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-19

TABLE 1
CONCENTRATIONS OF BERYLLIUM, COPPER, AND LEAD DETECTED IN SAMPLES OF SLAG

Evidence	Sample ID	Hazardous Substance	Conc.	DL	Unit	Reference
Slag	Cell 51-55 98061222	Lead	24,700 (EP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-19
	Cell 51-55 98061222	Lead	30,100 (TCLP)	NA	Fg/L	4, Attachment 3, pp. A-3-5, A-3-8, A-3-13, and A-3-20
Slag	2154-104	Lead	8,150	NA	mg/kg	4, Attachment 4, p. A-4-1
	2154-104	Lead	27.3	NA	mg/L	4, Attachment 4, p. A-4-1
	2154-105	Lead	6,110	NA	mg/kg	4, Attachment 4, p. A-4-2
	2154-105	Lead	17.5	NA	mg/L	4, Attachment 4, p. A-4-2
	2154-106	Lead	4,861	NA	mg/kg	4, Attachment 4, p. A-4-3
	2154-106	Lead	17.7	NA	mg/L	4, Attachment 4, p. A-4-3
	2154-107	Lead	7,528	NA	mg/kg	4, Attachment 4, p. A-4-4
	2154-107	Lead	44.7	NA	mg/L	4, Attachment 4, p. A-4-4
	2154-108	Lead	5,989	NA	mg/kg	4, Attachment 4, p. A-4-5
	2154-108	Lead	24.6	NA	mg/L	4, Attachment 4, p. A-4-5
Slag	SP-01	Lead	5,550 J	0.1	mg/kg	4, p. 5 and Attachment 6, p. A-6-2; 21, pp. 5 and 42
	SP-01	Beryllium	129 J	1	mg/kg	4, p. 5 and Attachment 6, p. A-6-2; 21, pp. 5 and 42
	SP-01	Copper	13,200	5	mg/kg	4, p. 5 and Attachment 6, p. A-6-2; 21, pp. 5 and 42
	SP-01	Lead	7,400	0.1	Fg/L	20, pp. 10 and 21
	SP-02	Lead	6,050 J	0.1	mg/kg	4, p. 5 and Attachment 6, p. A-6-3; 21, pp. 6 and 42
	SP-02	Beryllium	118 J	1	mg/kg	4, p. 5 and Attachment 6, p. A-6-3; 21, pp. 6 and 42
	SP-02	Copper	16,500	5	mg/kg	4, p. 5 and Attachment 6, p. A-6-3; 21, pp. 6 and 42

TABLE 1
CONCENTRATIONS OF BERYLLIUM, COPPER, AND LEAD DETECTED IN SAMPLES OF SLAG

Evidence	Sample ID	Hazardous Substance	Conc.	DL	Unit	Reference
Slag	SP-02	Lead	21,300	0.1	Fg/L	20, pp. 11 and 21
	SP-03	Beryllium	129 J	1	mg/kg	4, p. 5 and Attachment 6, p. A-6-5; 21, pp. 7 and 42
	SP-03	Copper	16,600	5	mg/kg	4, p. 5 and Attachment 6, p. A-6-5; 21, pp. 7 and 42
	SP-03	Lead	6,370 J	0.1	mg/kg	4, p. 5 and Attachment 6, p. A-6-5; 21, pp. 7 and 42
	SP-03	Lead	15,400	0.1	Fg/L	20, pp. 12 and 21
	SP-03A	Lead	5,770 J	0.1	mg/kg	4, p. 5 and Attachment 6, p. A-6-4; 21, pp. 8 and 42
	SP-03A	Beryllium	121 J	1	mg/kg	4, p. 5 and Attachment 6, p. A-6-4; 21, pp. 8 and 42
	SP-03A	Copper	13,300	5	mg/kg	4, p. 5 and Attachment 6, p. A-6-4; 21, pp. 8 and 42
	SP-03A	Lead	17,800	0.1	Fg/L	20, pp. 13 and 21
Bagged Product	SP-04	Lead	22,100 J	0.1	mg/kg	4, p. 5 and Attachment 6, p. A-6-10; 21, pp. 9 and 42
	SP-04	Beryllium	86.1 J	1	mg/kg	4, p. 5 and Attachment 6, p. A-6-10; 21, pp. 9 and 42
	SP-04	Copper	46,400 J	5	mg/kg	4, p. 5 and Attachment 6, p. A-6-10; 21, pp. 9 and 42
	SP-04	Lead	6,010	0.1	Fg/L	20, pp. 14 and 21
Slag	SP-10	Lead	3,170	0.1	ppm	22, p. 4
	SP-10	Beryllium	110	1	ppm	22, p. 4
	SP-10	Copper	8,10	5	ppm	22, p. 4

Notes:

EP	Extraction procedure
ID	Identification
J	Estimated values (Ref. 4, Attachment 6, p. A-6-1)
mg/kg	milligram per kilogram
mg/L	milligram per liter
ppm	parts per million
TCLP	toxicity characteristics leachate procedures
Fg/L	microgram per liter

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for the slag pile.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): 0

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous waste stream for the slag pile.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: 0

2.4.2.1.3 Volume

The volume of the slag pile remaining on the site is estimated to be 68,000 cubic yards (Ref. 5, p. 2). The hazardous waste quantity (HWQ) value is based on volume (68,000 ÷ 2.5 [pile] = 27,200) (Ref. 1, Table 2-5).

Dimension of source (yd^3 or gallons): 68,000
Volume Assigned Value: 27,200

2.4.2.1.4 Area

Because the volume could be determined, the area value is not evaluated (Ref. 1, Section 2.4.2.1.3).

Area of source (ft^2): Not evaluated (NE)
Area Assigned Value: 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source HWQ value for the slag pile is assigned the value for the volume of the pile.

Source Hazardous Waste Quantity Value: 27,200
(Ref. 1, Section 2.4.2.1.5)

TABLE 2

SUMMARY OF SITE SOURCE DESCRIPTIONS

Source Number	Source Name	Source HWQ Value	Source Containment Values			
			Ground Water	Surface Water	Air Gas	Air Particulate
1	Slag Pile	27,200	NS	10	10	10

NS Not scored
HWQ Hazardous waste quantity

HWQ Total = 27,200

OTHER SOURCES

The slag pile is the only source evaluated on the FSP site. Other sources of potential contamination are associated with the site and were not evaluated because inclusion of the sources does not significantly affect the site score. Other potential sources of contamination at the FSP site include: contaminated soil surrounding the slag pile (Refs. 4, p. 5, Attachment 5, and Attachment 6, pp. A-6-11 - A-6-15; 22, pp. 1 - 4); contaminated soil associated with inactive Conrail railroad bed (Refs. 18, pp. 2 and 3; 19, pp. 1 and 2 and Appendix B); and contaminated soil and sediment in the wetlands located on PWD property (Refs. 4, p. 3; 5, pp. 3 - 4; 15, pp. 2 and 4).

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 Overland/Flood Migration Component

4.1.1.1 Definition of Hazardous Substance Migration Pathway for Overland Flow/Flood Component

Surface-water runoff from the slag pile flows along two separate surface-water migration pathways: towards a wetland located on the northeastern side of the slag pile or along storm sewers located on Castor and Delaware Avenues. Water in the wetland discharges into the PWD Northeast Treatment Plant (Ref. 72, p. 1). The storm sewers discharge into the Delaware River (Ref. 5, pp. 1and 4; 4, p. 3; 5, pp. 3 and 4; 59, p. 2; 60, pp. 1 and 3; 62, pp. 1 and 2; 63, p. 2; 72, pp. 1 and 2). The storm sewers follow Castor and Delaware Avenues and flow approximately 2,000 feet south to the Tioga Marine Terminal and finally to the Delaware River (Refs. 23; 60, pp. 1, 3, and 4; 72, pp. 1 and 2). The probable point of entry (PPE) to surface water is shown on Figure 3. The Delaware River flows to the south along Philadelphia, Pennsylvania, and is the only surface-water body within the 15-mile downstream target distance limit (TDL) (Ref. 24). The Delaware River is tidally influenced and is considered to be brackish, with a sodium concentration of 100 mg/L (Ref. 25, pp. 93-49).

According to the EPA On-Scene Coordinator (OSC), Douglas Fox, and from observations made of the slag pile, black grit from the slag pile was observed in and removed from the isolated wetland located on the northeastern side of the slag pile (Refs. 4, p. 3; 5, p. 4; 15, p. 2). The black grit observed in the wetland is slag from the slag pile. As documented in Section 2.4.1, the slag contains beryllium, copper, and lead. Therefore, beryllium, copper, and lead were released from the slag pile to the wetland. The extent of contamination in the isolated wetland has not been adequately documented. Therefore, the surface-water migration pathway evaluated for the site begins at the PPE into the storm sewers located on Castor Avenue.

During the emergency response action, slag was caked on the storm sewer grates. The slag was removed from the grates and from inside the storm sewers (Ref. 5, p. 2). The presence of slag inside the storm sewers indicates that slag containing beryllium, copper, and lead was released to the storm sewers. Discharges of storm sewers from the slag pile flows to the City of Philadelphia’s municipal separate storm sewer system, which discharges directly to the Delaware River (Ref. 30, p. 3).

Inspections conducted by the PADEP (formerly the Pennsylvania Department of Environmental Resources [PADER]) indicated that the slag pile was releasing contaminants to the Delaware River (Refs. 59, p. 2; 60, pp. 1, 3, and 4; 62, pp. 1 and 2; 63, p. 2). PADEP issued a notice of violation to MDC for not protecting the slag pile from precipitation (Ref. 61, pp. 1 and 2).

EPA Region III Water Protection Division (WPD) issued an Administrative Order for Compliance (AOC) to MDC pursuant to the Clean Water Act that ordered MDC to install best management practices immediately to control the discharge of pollutants in storm water runoff (Ref. 15, p. 10). A Findings of Violations and Order for Compliance was issued to MDC on September 13, 1999 (Ref. 30, p. 6). According to the order, storm water runoff was observed from the slag pile; the runoff contained several pollutants. Samples of the storm water contained high levels of copper, lead, zinc, and total suspended solids in the storm water (Refs. 30, pp. 2 and 3; 57). Discharges of storm water from the slag pile flowed to the City of Philadelphia’s municipal separate storm sewer system, which discharges directly to the Delaware River (Ref. 30, p. 3).

A copy of the *Figure 3* is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Samples collected from the MDC storm water runoff revealed the following concentrations of lead (Refs. 30, pp. 2 and 3; 57): 7 mg/L (Refs. 31, p. 1; 32, pp. 1 and 16; 57); 1.9 mg/L (Refs. 31, p. 1; 33, pp. 1 and 14; 57); 2.7 mg/L (Refs. 34, pp. 1; 6; 57); 4.55 mg/L (Refs. 31, p. 2; 35 pp. 1 and 4; 57); 6.4 mg/L (Refs. 31, p. 2; 35, pp. 3 and 4; 57); and 0.289 mg/L (Refs. 31, p. 2; 35, pp. 3 and 4; 57). Therefore, lead contained in storm water from the slag pile was discharged directly to the Delaware River.

4.1.2.1 LIKELIHOOD OF RELEASE

The surface-water migration pathway is evaluated using the criteria for a potential to release hazardous substances.

4.1.2.1.2 POTENTIAL TO RELEASE

An observed release to surface water cannot be established for the Delaware River; therefore, the potential to release by overland flow and the potential to release by flood for the Delaware River is evaluated (Ref. 1, Section 4.1.2.1.2).

4.1.2.1.2.1 Potential to Release by Overland Flow

Surface-water runoff from the slag pile flows to the storm sewers located on Castor and Delaware Avenues and flows approximately 2,000 feet to the Delaware River (Ref. 5, pp. 1 and 4; 60, pp. 1, 3, and 4; 23).

4.1.2.1.2.1.1 <u>Containment</u>

The containment factor value for the surface-water migration pathway is evaluated for the source prior to capping the pile or prior to the removal actions because wastes remain on the site. The removal actions included the implementation of temporary surface-water drainage controls and a temporary covering of the slag pile (Ref. 15, pp. 1 and 6). Surface-water runoff from the slag pile flowed to a wetland located on the northeast side of the slag pile or to storm sewers located along Castor and Delaware Avenues. The wetland discharges to the PWD Northeast Treatment Plant (Ref. 72, p. 1). The storm sewers discharge to the Delaware River (Refs. 5, pp. 1 and 4; 60, p. 1; 72, pp. 1 and 2). The slag pile was not covered while it was in operation (Ref. 15, p. 2). There is no documentation of containment for flood while the source operated; therefore, a containment factor of 10 was assigned (Refs. 1, Table 4-8; 5, pp. 1 and 4; 15, p. 2; 59, p. 2; 61, p. 2; 61, p. 1; 63, p. 2).

TABLE 3
CONTAINMENT FACTOR VALUE FOR THE SLAG PILE

Source	Source Hazardous Waste Quantity Value > or = 0.5	Containment Descriptor	Containment Factor Value
Slag Pile	Yes	No evidence of hazardous substance migration from source area is present, and neither of the following are present: (1) maintained engineered cover or (2) functioning and maintained run-on control system and runoff management system.	10

Containment Factor Value: 10

4.1.2.1.2.1.2 Runoff

Runoff is evaluated for three components: rainfall, soil group, and drainage area.

Drainage Area

The slag pile is located in the city of Philadelphia, Pennsylvania. The area surrounding the slag pile is level because of its location on the bank of the Delaware River (Ref. 23). Surface-water runoff from the slag pile and the surrounding area is controlled by a network of storm sewers (Ref. 60, pp. 1, 3, and 4). The drainage area for the slag pile is estimated to be the area of the lot on which the slag pile is located, 165,000 square feet (ft^2) or 3.79 acres (165,000 acres ÷ 43,560 ft^2/acre = 3.79 acres) (Refs. 23; 4, p. 1).

Drainage Area for the Watershed: 3.79 acres

A value is assigned to the drainage area for the watershed based on the drainage area (3.79 acres) for the watershed from Reference 1, Table 4-3. That value is 1.

Drainage Area Assigned Value: 1

Rainfall

The 2-year, 24-hour rainfall for the site is estimated from the rainfall frequency atlas of the United States as 3.0 to 3.5 inches (Ref. 68, p. 2).

2-year, 24-hour Rainfall (inches): 3.0 - 3.5

Soil Group

The area around the site is paved with cement or asphalt. A dominant soil type cannot be determined because of the extensive urbanization of the site area (Refs. 23; 28, pp. 3-6 and 3-7). The soil type assigned for the site is soil group designation D (Ref. 1, Section 4.1.2.1.2.1.2, Table 4-4). That soil group is selected because of low infiltration rates through impermeable surfaces (Ref. 1, Section 4.1.2.1.2.1.2, Table 4-4).

TABLE 4
SOIL GROUP DESIGNATION

Soil Group	Reference	Soil Group Designation
Impermeable surfaces	23; 28, pp. 3-6 and 3-7	D

A rainfall-runoff value is obtained from Reference 1, Table 4-5, using the soil group designation and the 2-year, 24-hour rainfall value, the rainfall-runoff value is 6 (Ref. 1, Table 4-5).

2-year, 24-hour Rainfall: 3.5 to 4 inches
Soil Group Designation: D
Rainfall/Runoff Value: 5
Drainage Area Value: 1

The runoff factor value for the watershed is assigned using Reference 1, Table 4-6 and the rainfall-runoff value (5) and the drainage area value (1).

Runoff Factor Value: 1

4.1.2.1.2.1.3 Distance to Surface Water

The distance to surface water is estimated to be 2,000 feet. That distance is estimated by measuring the overland flow distance from the slag pile along the storm sewer to surface water (Refs. 23; 60, pp. 1, 3, and 4).

TABLE 5
DISTANCE TO SURFACE WATER

Source	**Distance to Surface Water**	**Reference**
Slag Pile	2,000 feet	23; 60, pp. 1, 3, and 4

The shortest distance to surface water factor value is assigned from Reference 1, Table 4-7, using the distance to surface water, 2,000 feet (Ref. 1, Section 4.1.2.1.2.1.3).

Distance to Surface Water Factor Value: 9

4.1.2.1.2.1.4 Overland Flow Potential to Release Factor Value

The overland flow potential to release factor value is determined by summing the factor values for runoff (1) and distance to surface water factor value (9) for the Delaware River and multiplying the sum by the factor value for containment (10). The resulting product is the factor value for potential to release by overland flow for the Delaware River (Ref. 1, Section 4.1.2.1.2.1.4).

1 (runoff factor value) + 9 (distance to surface water factor value) = 10 (sum)

10 (sum) × 10 (containment factor value) = 100 potential to release by overland flow

Potential to Release by Overland Flow: 100

4.1.2.1.2.1 Potential to Release by Flood

The potential to release by flood is the product of two factors: containment (flood) and flood frequency. A containment (flood) factor value is assigned using Reference 1, Table 4-8 and a flood frequency factor value is assigned for the floodplain category in which the slag pile is located using Reference 1, Table 4-9. The containment (flood) factor value for the slag pile is evaluated for the source prior to capping the pile or prior to the removal actions because wastes remain on the site. The removal actions included the implementation of temporary surface-water drainage controls and a temporary covering of the slag pile (Ref. 15, pp. 1 and 6). Surface-water runoff from the slag pile flowed to a wetland located on the northeast side of the slag pile or to storm sewers located along Castor and Delaware Avenues. The wetland discharges to the PWD Northeast Treatment Plant (Ref. 72, pp. 1 and 2). The storm sewers discharge to the Delaware River (Ref. 5, pp. 1 and 4; 60, pp. 1, 2, and 3; 62, p. 2; 72, pp. 1 and 2). The slag pile was not covered while it was in operation (Ref. 15, p. 1). There is no documentation of containment for the slag pile; therefore, a containment (flood) factor of 10 was assigned (Refs. 1, Table 4-8; 5, pp. 1 and 4; 59, p. 2; 60, pp. 1 and 3; 61, p. 2; 62, p. 2; 63, p. 2).

The slag pile is located in a 100-year floodplain (Ref. 69); therefore, a flood frequency factor value of 25 is assigned from Reference 1, Table 4-9.

TABLE 6
POTENTIAL TO RELEASE BY FLOOD

Hazardous Waste Quantity Value Source 0.5 (yes/no)	Containment (Flood) Factor Value	Flood Frequency Factor Value	Potential to Release by Flood Factor Value
Yes	10	25	250

Potential to Release by Flood Factor Value: 250

4.1.2.1.2.3 Potential to Release Factor Value

The potential to release factor value is the sum of the factor values assigned to the watershed for potential to release by overland flow (100) and potential to release by flood (250) (Ref. 1, Section 4.1.2.1.2.3).

Potential to Release Factor Value: 350

4.1.2.2 WASTE CHARACTERISTICS

4.1.2.2.1 Toxicity/Persistence

The toxicity, persistence, and the combined toxicity-persistence factor values for beryllium, copper, and lead are summarized in the table below.

TABLE 7
TOXICITY/PERSISTENCE FACTOR VALUES

Hazardous Substance	Source	Toxicity Factor Value	Persistence Factor Value (Ref. 1, 4.1.2.2.1.2)	Toxicity/ Persistence Factor Value	Reference
Beryllium	1	10,000	1	10,000	2, p. B-3
Copper	1	***	1	***	2, p. B-6
Lead	1	10,000	1	10,000	2, p. B-13

Toxicity/Persistence Factor Value: 10,000
(Ref. 1, Table 4-12)

4.1.2.2.2 Hazardous Waste Quantity

The source HWQ value is summarized in the table below.

TABLE 8
HAZARDOUS WASTE QUANTITY

Source	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is Source Hazardous Constituent Quantity Data Complete? (yes/no)
Slag Pile	27,200	No

The source HWQ value is 27,200 is greater than 10,000 and less than 1 million and has an assigned HWQ factor value of 10,000 (Ref. 1, Table 2-6).

HWQ Factor Value: 10,000

4.1.2.2.3 Waste Characteristic Factor Category Value

The waste characteristic factor category value is obtained by multiplying the toxicity/persistence factor value (10,000) (Section 4.1.2.2.1) and the HWQ factor value (10,000) (Section 4.2.2.2). Based on this product (1×10^8), the waste characteristic factor category value is 100 (Ref. 1, Table 2-7).

Toxicity/persistence factor value (10,000) × HWQ factor value (10,000): 1×10^8 (subject to a maximum of 1×10^{12}).

Waste Characteristic Factor Value: 100

4.1.2.3 DRINKING WATER TARGETS

No surface-water intakes have been identified within the 15-mile downstream TDL. A surface-water intake for the PWD Baxter Water Treatment Plant is located on the Delaware River approximately 5.5 miles upstream of the site (Refs. 27; 24). The Delaware River tide is documented to carry effluent from the NEWPCP past the intake point for the PWD Baxter Water Treatment Plant (Ref. 26, pp. V-29, V-31, and V-32).

The intake serves 1,053,000 people with drinking water; 60 percent of the total population (1,755,000) served by PWD. The only source of the water supplies to this population is the Delaware River (Ref. 27).

No Level I or II concentrations have been documented at the Baxter Treatment Plant intake.

4.1.2.3.1 Nearest Intake

No surface water intakes have been identified within the 15-mile downstream TDL. A surface water intake for the PWD Baxter Water Treatment Plant is located on the Delaware River approximately 5.5 miles upstream of the site (Refs. 27; 23). The Delaware River flood tide is documented to carry effluent discharged from the NEWPCP past the intake point for the PWD Baxter Water Treatment Plant (Ref. 26, pp. V-29 and V-32). Therefore, the TDL includes 15 miles downstream of the PPE and 5.5 upstream of the PPE (Ref. 1, Section 4.1.1.2).

The intake serves 1,053,000 people with water; 60 percent of the total population (1,755,000) served by PWD (Ref. 27).

Location of Nearest Drinking Water Intake:

5.5 miles upstream of the site (Refs. 24, 26, pp. V-29, V-31, and V-32; 27).

Distance from the PPE:

5.5 miles

Potential Contamination:

No drinking water intakes are subject to Level I or II concentrations; therefore, the potential contamination of a drinking water intake is evaluated. The surface-water intake evaluated is located on the Delaware River 5.5 miles upstream of the site. The Delaware River at the Trenton, New Jersey gauging station (the closest station to the site) has a average annual flow (long-term median flow) of 9,590 cubic feet per second (cfs) (Ref. 36, pp. 1 and 2). Since the gauging station is upstream from the PPE, the flow rate at the PPE is expected to be higher than 9,590 cfs. The flow rate at the PPE is estimated to range from 10,000 to 100,000 cfs (Ref. 1, Table 4-13).

Type of Surface-Water Body:

Large River

Since the gauging station is upstream from the PPE, the flow rate at the PPE is expected to be higher than 9,590 cfs. The flow rate at the PPE is estimated to range from 10,000 to 100,000 cfs (Ref. 1, Table 4-13). Based on this flow rate, the type of surface-water body is “large river,” and a dilution weight of 0.0001 is assigned from Reference 1, Table 4-13.

Dilution Weight: 0.0001

To determine the nearest intake factor value, the dilution weight, 0.0001, is multiplied by 20, yielding a value of 0 (Ref. 1, Section 4.1.2.3.1).

Nearest Intake Factor Value: 0

4.1.2.3.2 Population

No Level I or II concentrations have been documented at a surface-water intake. Therefore, no Level I or II populations have been identified (Ref. 1, Section 4.1.2.3.2.1).

4.1.2.3.2.2 Level I Concentration

No Level I concentration has been documented.

Population Served by Level I Intakes: 0
Level I Population Factor Value: 0

4.1.2.3.2.3 Level II Concentration

No Level II concentration has been documented.

Population Served by Level II Intakes: 0
Level II Population Factor Value: 0

1.2.3.2.4 Potential Contamination

The Baxter Water Treatment Plant has a surface-water intake on the Delaware River 5.5 miles upstream of the site (Refs. 27; 24). The closest gauging station to the intake on the Delaware River is the Trenton, New Jersey, gauging station. That station has a average annual flow of 9,590 cubic feet per second (cfs) (Ref. 36, p. 1). Since the gauging station is upstream from the PPE, the flow rate at the PPE is expected to be higher than 9,590 cfs. The gauging station is located approximately 32 miles upstream of the FSP (Ref. 67). The flow rate at the PPE is estimated to range from 10,000 to 100,000 cfs (Ref. 1, Table 4-13). The Delaware River flood tide is documented to carry effluent discharged from the NEWPCP past the intake point for the PWD Baxter Water Treatment Plant (Ref. 26, pp. V-29 and V-32). NEWPCP is located adjacent to the site (Ref. 5, pp. 2 and 3).

The intake serves 1,053,000 people with water; this is 60 percent of the total population (1,755,000) served by PWD. The water that serves this population is not blended with any other water before it is distributed. Water from the Delaware River is stored in reservoirs for emergency supplies (Ref. 27). The flow at the location of the surface-water intake and the population served are summarized in the table below.

TABLE 9
POPULATION SERVED BY THE BAXTER TREATMENT PLANT

Intake	Average Annual Flow (cfs)	Population Served	References
Baxter Treatment Plant	10,000 to 100,000	1,053,000	26, pp. V-29, V-32; 27; 36, p. 1

The Baxter Treatment Plant surface-water intake is the only drinking-water intake identified on the Delaware River within the TDL. The dilution-weighted population served by this intake is summarized in the table below.

TABLE 10
DILUTION-WEIGHTED POPULATION

Type of Surface-Water Body	Total Population	Dilution-Weighted Population (Ref. 1, Table 4-14)
Large River	1,053,000	163

The potential contamination factor value is the dilution-weighted population, 163, multiplied by 1/10 or 16 (Ref. 1, Section 4.1.2.3.2.4).

Dilution-Weighted Population Served by Potentially Contaminated Intakes: 163
Potential Contamination Factor Value: 16

4.1.2.3.3 Resources

The Delaware River is used for recreation: boating and fishing (Ref. 64, pp. 1 - 3).

Resource Factor Value: 5
Ref. 1, Section 4.1.2.3.3

4.1.3.2 WASTE CHARACTERISTICS

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

The toxicity, persistence, and bioaccumulation factor values for beryllium, copper, and lead are summarized in the table below.

TABLE 11
TOXICITY, PERSISTENCE, AND BIOACCUMULATION FACTOR VALUES

Hazardous Substance	Source	Toxicity Factor Value	Persistence Factor Value	Bioaccumulation Value	Toxicity/ Persistence/ Bioaccumulation Factor Value	Reference
Beryllium	1	10,000	1	50[a]	5×10^5	2, p. B-3
Copper	1	***	1	***	***	2, p. B-6
Lead	1	10,000	1	5,000[a]	5×10^7	2, p. B-13

Notes:
[a] The Delaware River is brackish; therefore, the higher of the fresh water and saltwater factor values is assigned (Refs. 1, Section 4.1.3.2.1.3; 25, p. 93-49)

The highest toxicity/persistence/bioaccumulation factor value is for lead.

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^7

4.1.3.2.2 Hazardous Waste Quantity

The HWQ factor value is 10,000, as documented in Section 4.1.2.2.2

4.1.3.2.3 Waste Characteristics Factor Category Value

The waste characteristic factor category value is obtained by multiplying the highest toxicity and persistence factor value by the HWQ factor value and multiplying the product by the bioaccumulation factor value for that hazardous substance (Ref. 1, Section 4.1.3.2.3). The product is assigned a waste characteristic factor category value from HRS Table 2-7 (Ref. 1, Section 2.4.3.1).

The highest toxicity and persistence factor value assigned to the surface-water migration pathway is for lead, which has a toxicity factor value of 10,000 and a persistence factor value of 1. The bioaccumulation factor value for lead is 5,000 (Ref. 2, p. B-13).

Toxicity/Persistence (10,000) $\times$ HWQ factor value (10,000) = 1×10^8 (subject to a maximum of 1×10^8)
$1 \times 10^8 \times 5{,}000 = 5 \times 10^{11}$ (subject to a maximum of 1×10^{12})

A waste characteristics factor category value of 560 was assigned from HRS Table 2-7 (Ref. 1, Section 2.4.3.1).

Hazardous Waste Quantity Assigned Value: 5×10^{11}
Waste Characteristic Category Value: 560

4.1.3.3 HUMAN FOOD CHAIN THREAT-TARGETS

<u>Actual Human Food Chain Contamination</u>

Surface-water and Sediment Samples

No surface-water or sediment samples have been collected for the site.

Closed Fishery

No closed fisheries have been identified within the downstream TDL.

Benthic Tissue

No benthic tissues samples have been collected within the TDL.

<u>Level I Concentrations</u>

No Level I concentrations can be documented for a fishery within the TDL. No tissue samples have been collected.

<u>Most Distant Level II Sample</u>

No Level II sample concentrations can be documented for a fishery within the TDL. No sediment samples have been obtained from the Delaware River (Ref. 1, Section 4.1.3.3).

4.1.3.3.1 Food Chain Individual

An observed release of hazardous substances with a bioaccumulation factor value of greater than 500 has not been documented from the site. A food-chain individual factor value of 0 is assigned (Ref. 1, Section 4.1.3.3.1).

Food Chain Individual Factor Value: 0

4.1.3.3.2 Population

4.1.3.3.2.1 **Level I Concentrations**

Sum of Human Food Chain Population Values: 0

Level I Concentration Factor Values: 0

4.1.3.3.2.2 **Level II Concentrations**

Sum of Human Food Chain Population Values: 0

Level II Concentration Factor Values: 0

4.1.3.3.2.3 **Potential Human Food Chain Contamination**

The Delaware River is the only surface-water body within the downstream TDL (Ref. 24). The Delaware River is a warm-water fishery (Ref. 25, pp. 93-6 and 93-49). No accurate data on pounds of fish or number of fish caught per year have been identified, therefore, a minimum production value is assigned from HRS Table 4-18 (Ref. 1, Table 4-18). The annual production in pounds for the Delaware River potential human food chain contamination is greater than zero since it is used for fishing (Ref. 25, pp. 93-6 and 93-49).

TABLE 12
POTENTIAL HUMAN FOOD CHAIN CONTAMINATION FACTOR VALUE

Identity of Fishery	Annual Production (pounds)	Surface Water Dilution (D)	Reference	Human Food Chain Population Value (P)
Delaware River	Greater than 0	0.0001	25, p. 93-49; 36	0.03

The potential human food chain contamination factor value (PF) is determined by multiplying the human food-chain population value (P) by the surface-water dilution-weighed value (D) (Ref. 1, Table 4-13) and dividing by 10 (PF 0.03 [P × 0.0001]/10 = 3×10^{-7}).

Potential Human Food Chain Contamination Factor Value: 3×10^{-7}
(Ref. 1, Section 4.1.3.3.2.3)

4.1.4.2 WASTE CHARACTERISTICS

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

The ecosystem toxicity/persistence/bioaccumulation factor values for beryllium, copper, and lead are summarized in the table below.

TABLE 13
ECOSYSTEM TOXICITY/PERSISTENCE FACTOR VALUES

Hazardous Substance	Source	Ecosystem Toxicity Factor Value	Persistence Factor Value	Ecosystem Toxicity/ Persistence Factor Value	Reference
Beryllium	1	-- (a)	1	N/A	1, Section 4.1.4.2.1.4; 2, p. B-3
Copper	1	100	1	100	1, Section 4.1.4.2.1.4; 2, p. B-6
Lead	1	1,000	1	1,000	1, Section 4.1.4.2.1.4; 2, p. B-13

(a) no value exists in SCDM

The ecosystem toxicity/persistence factor value, the bioaccumulation factor value, and the combined toxicity/persistence/bioaccumulation factor values for beryllium, copper, and lead are summarized in the table below.

TABLE 14
ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES

Hazardous Substance	Ecosystem Toxicity/Persistence Factor Value	Bioaccumulation Factor Value	Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value	Reference
Beryllium	N/A	50	N/A	1, Section 4.1.4.2.1.4; 2, p. B-3
Copper	100	50,000	5×10^6	1, Section 4.1.4.2.1.4; 2, p. B-6
Lead	1,000	5,000	5×10^6	1, Section 4.1.4.2.1.4; 2, p. B-13

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^6

4.1.4.2.2 Hazardous Waste Quantity

The HWQ factor value is 10,000, as documented in Section 4.1.2.2.2.

4.1.4.2.3 Waste Characteristic Factor Category Value

The waste characteristic factor category value is obtained by multiplying the highest toxicity and persistence factor value for the watershed by the HWQ factor value and multiplying this product by the bioaccumulation factor value for that hazardous substance (Ref. 1, Section 4.1.4.2.3). The product is assigned a waste characteristics factor category value from HRS Table 2-7 (Ref. 1, Section 4.1.4.2.3). The highest toxicity and persistence factor value assigned to the surface-water migration pathway is for lead (1,000) which has a ecosystem toxicity factor value of 1,000 and a persistence factor value of 1. The bioaccumulation factor value for lead is 5,000 (Ref. 2, p. B-13).

Toxicity/Persistence (1,000) × HWQ factor value (10,000) = 1×10^7 (subject to a maximum of 1×10^8)
5×10^7 × Bioaccumulation factor value (5,000) = 5×10^{10} (subject to a maximum of 1×10^{12})

A waste characteristic factor category value of 320 was assigned from HRS Table 2-7 (Ref. 1, Table 2-7).

Hazardous Waste Quantity Assigned Value: 5×10^{10}
Waste Characteristics Category Value: 320

4.1.4.3 ENVIRONMENTAL THREAT - TARGETS

<u>Level I Concentrations</u>

No Level I concentrations have been documented because an observed release by direct observation was documented to surface water.

<u>Most Distant Level I Sample</u>

None has been documented.

<u>Most Distant Level II Sample</u>

No Level II samples have been documented.

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

<u>Sensitive Environments</u>

No Level I sensitive environments have documented.

Sum of Sensitive Environment Value: 0

<u>Wetlands</u>

No Level I wetlands have been documented.

Total Wetland Frontage: 0 miles
Wetland Value: 0
Sum of Sensitive Environments value + Wetland Value × 10: 0
Level I Concentrations Factor Value: 0

4.1.4.3.1.2 Level II Concentrations

<u>Sensitive Environments</u>

No Level II concentrations have been documented.

Sum of Sensitive Environments Value: 0

<u>Wetlands</u>

No wetlands have been identified subject to Level II concentrations.

Total Wetlands Frontage: 0
Wetlands Value: 0
Sum of Sensitive Environments Value + Wetlands Value = 0
Level II Concentrations Factor Value: 0

4.1.4.3.1.3 <u>Potential Contamination</u>

The Camden, New Jersey-Pennsylvania National Wetlands Inventory identifies the slag pile and the wetland located on the northeastern border of the slag pile as palustrine open water wetlands (Ref. 24). During the November 2000 site reconnaissance, the slag pile was observed to be covered with a cap, and the wetland was observed to be dry and vegetated with *Phragmites communis* (Ref. 5, pp. 2, 3, and 4). The wetland on the northeastern border of the slag pile was identified as an open water wetland (lagoon) in 1972 when the aerial photography for the National Wetlands Inventory was flown (Ref. 24). The extent of the lagoon may have been incorrectly estimated to encompass the slag pile. Observations made of the slag pile indicate that the slag pile is not a wetland and that the wetland on the northeastern border of the slag pile is a palustrine emergent wetland, rather than an open water wetland. Slag grit was observed in the wetland located on the northeastern side of the slag pile (Refs. 4, p. 3; 5, p. 3; 15, pp. 2). The extent of the Level II contamination in the wetland has not been determined to date; therefore, the wetland is not evaluated as a Level II sensitive environment.

The Delaware River is protected for the maintenance and propagation of fish species and fauna that are indigenous to a warm-water habitat. The Delaware River is state-protected for the passage, maintenance, and propagation of anadromous and catadromous fishes and other fishes that ascend to flowing waters to complete their life cycle (Ref. 25, pp. 93-6, 93-7, 93-45, 93-48, and 93-49).

The shortnose sturgeon (*Acipenser brevirostrum*), a Federally endangered species, is known to inhabit the Delaware River within the surface-water migration pathway (Ref. 29, pp. 337 and 340). The peregrine falcon (*Falco peregrinus*), a Federally endangered species, and the bald eagle (*Haliaeetus leucocephalus*), a Federally threatened species, hunts and feeds along the Delaware River (Ref. 28, p. 3-9).

TABLE 15
SENSITIVE ENVIRONMENTS - POTENTIAL CONTAMINATION

Sensitive Environment	Distance from PPE to Nearest Sensitive Environment	Reference	Value(s)
State-designated area for protection and maintenance of aquatic species	0	25, pp. 93-6, 93-7, 93-45, 93-48, and 93-49; 1, Table 4-23	5
Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time	0	25, pp. 93-6, 93-7, 93-45, 93-48, and 93-49; 1, Table 4-23	75
Habitat known to be used by Federally designated or proposed endangered or threatened species (*Acipenser brevirostrum*)	0	29, pp. 337 and 340; 1, Table 4-23	75
Habitat known to be used by Federally designated or proposed endangered or threatened species (*Haliaeetus leucocephalus*)	0	28, p. 3-9; 1, Table 4-23	75
Habitat known to be used by Federally designated or proposed endangered or threatened species (*Falco peregrinus*)	0	28, p. 3-9; 1, Table 4-23	75

Sum of Sensitive Environments Value: 305

Wetlands

The wetland frontage along the Delaware River is measured on Reference 24 for the TDL. The Delaware River is the only surface-water body within the TDL. A surface water intake for the PWD Baxter Water Treatment Plant is located on the Delaware River approximately 5.5 miles upstream of the site (Refs. 27; 23). The Delaware River flood tide is documented to carry effluent discharged from the NEWPCP past the intake point for the PWD Baxter Water Treatment Plant (Ref. 26, pp. V-29 and V-32). Therefore, the TDL includes 15 miles downstream of the PPE and 5.5 upstream of the PPE (Ref. 1, Section 4.1.1.2). The wetland frontage along the TDL is estimated to be 27.70 miles (Ref. 24).

The Delaware River at the Trenton, New Jersey gauging station (the closest station to the site) has a average annual flow (long-term median flow) of 9,590 cubic feet per second (cfs) (Ref. 36, pp. 1 and 2). Since the gauging station is upstream from the PPE, the flow rate at the PPE is expected to be higher than 9,590 cfs. The flow rate at the PPE is estimated to range from 10,000 to 100,000 cfs (Ref. 1, Table 4-13).

TABLE 16
WETLAND FRONTAGE

Type of Surface Water Body	Wetlands Frontage	Wetlands Value	References
Large River	27.70	500	24; 36, pp. 1 and 2; 1, Table 4-24

The table below provides the sum of the sensitive environment and wetland values assigned to the Delaware River. A dilution-weighted value is assigned from Reference 1, Table 4-13 for the Delaware River (0.0001). The sum of the sensitive environment and wetland values is multiplied by the dilution weight to get the dilution-weighted value.

TABLE 17
SENSITIVE ENVIRONMENT VALUES DILUTION WEIGHT SUM

Type of Surface Water Body	Sum of Sensitive Environment Values (S_j)	Wetland Frontage Value (W_j)	Dilution Weight (D_j)	Dilution Weight Sum $D_j(W_j + S_j)$
Large River	305	500	0.0001	0.0001 (805) = 0.0805

The potential contamination factor value (SP) is the sum of the dilution-weighted products divided by 10 (SP = 0.0805/10) (Ref. 1, Section 4.1.4.3.1.1)

Potential Contamination Factor Value: 0.00805

6.1.1 OBSERVED RELEASE

An observed release to the air migration pathway is established by both chemical analysis and direct observation in the sections below.

Direct Observation:

A direct observation of material from the slag pile entering the air migration pathway has been documented on numerous occasions and is summarized in the section below.

Basis for Direct Observation

During a hazardous waste inspection, dust from the slag pile was observed to be blowing around the area of the slag pile (Ref. 66, p. 6).

During the emergency response action, airborne releases of slag were observed when winds exceeded 5 miles per hour (mph). Winds between 10 to 15 mph were observed carrying large black dust clouds of material off of the slag pile to the northeast (Ref. 15, p. 2).

Tioga Marine Terminal employees complained to the EPA OSC of airborne black grit (slag) in their coffee and water. The employees stated that when trucks used their brakes, black grit was blown into the air from the road surface (Ref. 5, p. 2).

Also, during a snow storm, the EPA OSC observed black grit along Delaware Avenue. When the wind blew, slag was observed to enter the air (Ref. 5, p. 2).

In addition to the observation made of grit from the slag pile entering the air, grit was observed on the Tioga Marine Terminal property and on the inactive railroad track that parallels Delaware Avenue south of the slag pile (Ref. 18, p. 2). The analytical results from the soil samples collected from the area of the inactive railroad track revealed significant concentrations of beryllium, copper, and lead (Refs. 18; 19, Appendix B, pp. 1 to 4 and Appendix C, pp. C-1 to C-20). The analytical results from the soil samples collected from the area around the slag pile revealed significant concentrations of beryllium, copper, and lead (Refs. 4, p. 5, Attachment 5, and Attachment 6, pp. A-6-13, A-6-14, and A-6-15; 22, pp. 1 - 4). Soil surrounding the inactive and active railroad tracks were visibly contaminated with black grit from the slag pile (Ref. 52, pp. 24, 25, and 26). Slag was observed on the PWD property adjacent to the slag pile (Ref. 52, p. 19). The presence of grit or slag and elevated concentrations of beryllium, copper, and lead at these locations indicates that the grit or slag was carried by air and deposited on these locations and that the airborne grit contains beryllium, copper, and lead. Beryllium-, copper-, and lead-contaminated soil from the slag pile was excavated from along the inactive railroad track (Refs. 5, p. 1; 52, pp. 24, 25, and 26).

Hazardous Substances in the Release

As documented in Section 2.4.1, the slag pile or grit in the slag pile contains beryllium, copper, and lead. A summary of that documentation is provided in Table 1. In 1988, PADEP collected samples of soil containing slag from an area near the slag pile (Ref. 4, p. 1 and Attachment 1, p. A-1-1). In January 2000, EPA collected samples of soil containing grit from around the slag pile (Ref. 4, pp. 4 and 5). In March and April 2000, EPA collected samples of soil containing grit from an area around the slag pile (Ref. 22, pp. 1 - 4). In June 2000, EPA collected samples of soil containing slag from an inactive railroad located south of the slag pile (Refs. 18, pp. 2 and 3; 19, Attachment B, pp. 1 - 4). The presence of slag or grit and the presence of beryllium, copper, and lead in soil surrounding the slag pile provide evidence that the particles of slag were carried offsite by wind and that the particles of slag carried by the wind contain beryllium, copper, and lead. The concentrations of beryllium, copper, and lead detected in the samples are summarized in the table below. Concentrations reported in Fg/L or mg/L indicate that lead was analyzed by an EP or TCLP. The concentration reported as mg/kg is the total beryllium, copper, and lead detected in the sample.

TABLE 18
HAZARDOUS SUBSTANCES DETECTED IN SAMPLES OF SOIL CONTAINING SLAG

Sample Type	Sample ID	Hazardous Substance	Conc.	DL	Unit	Date	Reference
Soil and Slag	2135266	Lead	12,300	200	Fg/L	2/9/88	4, Attachment 1, pp. A-1-1, A-1-2, A-1-4, and A-1-7
Soil and Slag	SP-05	Lead	4,900 J	0.6	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-11; 21, pp. 3, 10, 42
	SP-05	Beryllium	93 J	1	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-11; 21, pp. 3, 10, 42
	SP-05	Copper	12,100 J	5	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-11; 21, pp. 3, 10, 42
	SP-05	Lead	14,400	200	Fg/L	1/5/00	20, pp. 8, 15
	SP-06	Lead	5,810 J	0.6	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-12; 21, pp. 3, 11, 42
	SP-06	Beryllium	113 J	1	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-12; 21, pp. 3, 11, 42
	SP-06	Copper	23,500 J	5	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-12; 21, pp. 3, 11, 42
	SP-06	Lead	13,200	200	Fg/L	1/5/00	20, pp. 8, 16
	SP-07	Lead	5,670 J	0.6	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-13; 21, pp. 3, 12, 42
Soil and Slag	SP-07	Beryllium	106 J	1	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-13; 21, pp. 3, 12, 42

TABLE 18
HAZARDOUS SUBSTANCES DETECTED IN SAMPLES OF SOIL CONTAINING SLAG

Sample Type	Sample ID	Hazardous Substance	Conc.	DL	Unit	Date	Reference
	SP-07	Copper	12,800 J	5	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-13; 21, pp. 3, 12, 42
	SP-07	Lead	11,200	200	Fg/L	1/5/00	20, pp. 8, 17
	SP-08	Lead	5,130 J	0.6	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-14; 21, pp. 3, 13, 42
	SP-08	Beryllium	101 J	1	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-14; 21, pp. 3, 13, 42
	SP-08	Copper	11,900	5	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-14; 21, pp. 3, 13, 42
	SP-08	Lead	13,700	200	Fg/L	1/5/00	20, pp. 8, 18
	SP-09	Lead	4,220 J	0.6	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-15; 21, pp. 3, 14, 42
	SP-09	Beryllium	100 J	1	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-15; 21, pp. 3, 14, 42
	SP-09	Copper	10,400	5	mg/kg	1/5/00	4, p. 5 and Attachment 6, p. A-6-15; 21, pp. 3, 14, 42
	SP-09	Lead	17,200	200	Fg/L	1/5/00	20, pp. 8, 19
Soil and Slag	SBS-01	Lead	6,660	NA	ppm	3/29/00	22, p. 2
	SBS-01	Beryllium	52.3	NA	ppm	3/29/00	22, p. 2
	SBS-01	Copper	13,300	NA	ppm	3/29/00	22, p. 2
	SBS-02	Lead	257	NA	ppm	3/29/00	22, p. 2
	SBS-02	Beryllium	1.9	NA	ppm	3/29/00	22, p. 2
	SBS-02	Copper	1,680	NA	ppm	3/29/00	22, p. 2
	SBS-03	Lead	2,450	NA	ppm	4/5/00	22, p. 3
	SBS-03	Beryllium	93.1	NA	ppm	4/5/00	22, p. 3
	SBS-03	Copper	6,890	NA	ppm	4/5/00	22, p. 3
Soil and Slag	SBS-04	Lead	1,290	NA	ppm	4/5/00	22, p. 3
	SBS-04	Beryllium	102	NA	ppm	4/5/00	22, p. 3

TABLE 18
HAZARDOUS SUBSTANCES DETECTED IN SAMPLES OF SOIL CONTAINING SLAG

Sample Type	Sample ID	Hazardous Substance	Conc.	DL	Unit	Date	Reference
	SBS-04	Copper	5,850	NA	ppm	4/5/00	22, p. 3
Soil[1]	RR2-01 MCWY80	Beryllium	21.4	1	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-1
	RR2-01 MCWY80	Copper	7,770	5	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-1
	RR2-01 MCWY80	Lead	2,790	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-1
	RR2-01A MCWY81	Beryllium	11.6	1	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-2
	RR2-01A MCWY81	Copper	4,260	5	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-2
	RR2-01A MCWY81	Lead	1,550	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-2
	RR2-02 MCWY82	Beryllium	33.5	1	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-3
	RR2-02 MCWY82	Copper	9,380	5	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-3
	RR2-02 MCWY82	Lead	3,480	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-3
	RR2-03 MCWY83	Beryllium	45.7	1	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-4
	RR2-03 MCWY83	Copper	17,700	5	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-4
	RR2-03 MCWY83	Lead	5,170	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 1 and Appendix C, p. C-4
	RR2-04 MCWY84	Beryllium	68.3	1	mg/kg	6/2700	18;19, Appendix B, p. 1 and Appendix C, p. C-5
Soil[1]	RR2-04 MCWY84	Copper	17,300	5	mg/kg	6/2700	18;19, Appendix B, p. 1 and Appendix C, p. C-5
	RR2-04 MCWY84	Lead	4,880	0.6	mg/kg	6/2700	18;19, Appendix B, p. 1 and Appendix C, p. C-5
	RR2-05 MCWY85	Beryllium	88.1	1	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-6

TABLE 18
HAZARDOUS SUBSTANCES DETECTED IN SAMPLES OF SOIL CONTAINING SLAG

Sample Type	Sample ID	Hazardous Substance	Conc.	DL	Unit	Date	Reference
	RR2-05 MCWY85	Copper	6,480	5	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-6
	RR2-05 MCWY85	Lead	4,710	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-6
	RR2-05A MCWY86	Beryllium	93.7	1	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-7
	RR2-05A MCWY86	Copper	7,380	5	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-7
	RR2-05A MCWY86	Lead	1,950	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-7
	RR2-06 MCWY87	Beryllium	79.5	1	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-8
	RR2-06 MCWY87	Copper	14,400	5	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-8
	RR2-06 MCWY87	Lead	4,980	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-8
	RR2-07 MCWY88	Beryllium	72.5	1	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-9
	RR2-07 MCWY88	Copper	10,100	5	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-9
	RR2-07 MCWY88	Lead	3,910	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-9
	RR2-08 MCWY89	Beryllium	97.1	1	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-10
	RR2-08 MCWY89	Copper	12,800	5	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-10
Soil[1]	RR2-08 MCWY89	Lead	4,590	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 2 and Appendix C, p. C-10
	RR2-09 MCYJ98	Beryllium	54.4	1	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-11
	RR2-09 MCYJ98	Copper	7,640	5	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-11

TABLE 18
HAZARDOUS SUBSTANCES DETECTED IN SAMPLES OF SOIL CONTAINING SLAG

Sample Type	Sample ID	Hazardous Substance	Conc.	DL	Unit	Date	Reference
	RR2-09 MCYJ98	Lead	2,880	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-11
	RR2-10 MCYJ99	Beryllium	50.6	1	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-12
	RR2-10 MCYJ99	Copper	6,610	5	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-12
	RR2-10 MCYJ99	Lead	2,510	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-12
	RR2-11 MCYK00	Beryllium	49.1	1	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-13
	RR2-11 MCYK00	Copper	6,790	5	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-13
	RR2-11 MCYK00	Lead	2,720	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-13
	RR2-11A MCYK01	Beryllium	11.1	1	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-14
	RR2-11A MCYK01	Copper	1,890	5	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-14
	RR2-11A MCYK01	Lead	777	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-14
	RR2-12 MCYK02	Beryllium	26.6	1	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-15
	RR2-12 MCYK02	Copper	3,550	5	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-15
	RR2-12 MCYK02	Lead	1,770	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 3 and Appendix C, p. C-15
Soil[1]	RR2-13 MCYK03	Beryllium	20.9	1	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-16
	RR2-13 MCYK03	Copper	2,360	5	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-16
	RR2-13 MCYK03	Lead	1,270	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-16

TABLE 18
HAZARDOUS SUBSTANCES DETECTED IN SAMPLES OF SOIL CONTAINING SLAG

Sample Type	Sample ID	Hazardous Substance	Conc.	DL	Unit	Date	Reference
	RR2-14 MCYK04	Beryllium	45.1	1	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-17
	RR2-14 MCYK04	Copper	2,360	5	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-17
	RR2-14 MCYK04	Lead	2,520	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-17
	RR2-15 MCYK05	Beryllium	32.1	1	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-18
	RR2-15 MCYK05	Copper	5,570	5	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-18
	RR2-15 MCYK05	Lead	2,240	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-18
	RR2-15A MCYK06	Beryllium	2.6	1	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-19
	RR2-15A MCYK06	Copper	1,080	5	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-19
	RR2-15A MCYK06	Lead	475	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-19
	RR2-16 MCYK07	Beryllium	36.2	1	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-20
	RR2-16 MCYK07	Copper	5,170	5	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-20
	RR2-16 MCYK07	Lead	2,150	0.6	mg/kg	6/27/00	18;19, Appendix B, p. 4 and Appendix C, p. C-20

Notes:

Conc.	Concentration
DL	Detection limits
ID	Identification
J	Estimated Values (Ref. 4, Attachment 6, p. A-6-1)
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NA	Not available
ppm	parts per million
Fg/L	microgram per liter

[1]No background sample was collected. A background sample was collected for the site in 1988 and for the adjacent Philadelphia Sludge Lagoons site (PWD) in 1989 (Refs. 4, p. 1, and Attachment 1, pp. A-1-1, A-1-2, and A-1-5; 28, Section 5.3, Sample Log and Figure 5.1, p. 5-5). The 1988 sample was analyzed by an extraction procedure and no lead was detected (Ref. 5, Attachment 1, pp. A-1-5 and A-1-6). The 1988 background sample was not analyzed for beryllium or copper. The 1989 background sample was analyzed by ICP (Ref. 28, Section 7, p. 7-5) revealing a beryllium concentration of 0.76 mg/kg, a copper concentration of 79.1 mg/kg, and a lead concentration of 122 mg/kg (Ref. 28, Section 7, pp. 7-1 - 7-6). Concentrations of beryllium above 4 mg/kg, copper above 190,000 mg/kg, and lead above 500 mg/kg exceed the Pennsylvania Department of Environmental Protection (PADEP) medium-specific concentrations (MSCs) for beryllium, copper, and lead in residential soil. Concentrations of beryllium above 18 mg/kg, copper above 190,000 mg/kg, and lead above 1,000 mg/kg exceed the PADEP MSCs for beryllium, copper, and lead in non-residential soil within 1- to 2-feet of the ground surface (Ref. 55, Table 4).

<u>Chemical Analysis - January 2000:</u>

In January 2000, air samples were collected from four sides of the slag pile as part of the perimeter sampling conducted during the response action (Refs. 37, p. 4; 39, pp. 2 and 4). The concentrations of beryllium, copper, and lead detected in the background and release samples are summarized in the sections below.

Background Concentration

On January 17, 2000, air samples were collected from four sides of the slag pile as part of the perimeter sampling conducted during the response action (Refs. 37, p. 4; 39, p. 4). The air samples were collected prior to any intrusive or disruptive response activities (Ref. 52, pp. 8, 13, and 14). The perimeter samples were collected at a flow rate of approximately 40 cubic feet per minute with high volume air samplers and were analyzed for priority pollutant metals (with the exception of mercury) (Refs. 38, p. D-1; 39, pp. 1 - 2). During the sampling event, weather data were collected. The samples were collected on January 18, 2000 (Ref. 39, p. 4). On that date, winds were blowing predominately from the north-northwest (Ref. 39, p. 3). One background sample was collected on the FSRC north yard, northwest of the slag pile. That sample is considered background because the winds were blowing predominately from the north-northwest on the date of sampling. Three downwind samples were collected: one on the PGW property on Delaware and Castor Avenues southwest of the slag pile, one from the Tioga Marine Terminal property southeast of the slag pile, and one from PWD property northeast of the slag pile (Figure 4) (Ref. 39, p. 4; 56). The samples were analyzed by EPA statement of work (SOW) SOW ILM04O for a 8.5- by 11-inch glass fiber filter paper (Ref. 38, p. 2). Table 19 summarizes the date, time, and height of the sampler used to collect the sample.

A copy of the *Figure 4* is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

TABLE 19
BACKGROUND AIR SAMPLE

Sample Identification	Date	Start Time	End Time	Height	Reference
TSP-4 R3760W1 MDCW-1	1/18/00	0640	1500	1.64 meters	38, pp. D-2 and C-1; 56; 39, p.1

The concentrations of beryllium, copper, and lead detected in the background sample and the detection limits are presented in the table below.

TABLE 20
CONCENTRATIONS OF BERYLLIUM, COPPER, AND LEAD
IN THE BACKGROUND AIR SAMPLE

Sample Identification	Hazardous Substance	Concentration Adjusted for Volume of Air Passed through the Filter (Fg/m^3)	Detection Limit (Fg/filter)	Reference
TSP-4 R3760W1 MDCW-1	Beryllium	(0.20 U Fg/filter) ÷ (945.767 m^3) = 0.000211468 U Fg/m^3	0.20	38, pp. C-1 and C-5
TSP-4 R3760W1 MDCW-1	Copper	(111 Fg/filter) ÷ (945.767 m^3) = 0.117365059 Fg/m^3	0.40	38, pp. C-1 and C-5
TSP-4 R3760W1 MDCW-1	Lead	(53.2 Fg/filter) ÷ (945.767 m^3) = 0.056250641 Fg/m^3	0.40	38, pp. C-1 and C-5

U = Not detected

TABLE 21
RELEASE AIR SAMPLES

Sample Identification	Date	Start Time	End Time	Elevation Mean Sea Level	Reference
TSP-3; R3760S1; MDCS-1	1/18/00	0700	1510	15 meters	38, pp. D-2 and C-2; 48, p. 1; 39, p. 1
TSP-2; R3760E1; MDCE-1	1/18/00	0715	1525	18 meters	38, pp. D-2 and C-3; 49, p. 1; 39, p. 1
TSP-5; R3760N1; MDCN-1	1/18/00	0915	1500	25 meters	38, pp. D-2 and C-4; 50, p. 1; 39, p. 1

The concentrations of beryllium, copper, and lead detected in the release samples and the detection limits are presented in the table below.

TABLE 22
CONCENTRATIONS OF BERYLLIUM, COPPER, AND LEAD IN THE RELEASE AIR SAMPLES

Sample Identification	Hazardous Substance	Concentration Adjusted for the Volume of Air Passed through the Filter (Fg/m^3)	Detection Limit (Fg/filter)	Reference
TSP-3 R3760S1 MDCS-1	Beryllium	(1.5 Fg/filter) ÷ (996.70802 m^3) = 0.001504954 Fg/m^3	0.20	38, pp. C-2 and C-5
TSP-3 R3760S1 MDCS-1	Copper	(442 Fg/filter) ÷ (996.70802 m^3) = 0.443459861 Fg/m^3	0.40	38, pp. C-2 and C-5
TSP-3 R3760S1 MDCS-1	Lead	(182 Fg/filter) ÷ (996.70802 m^3) = 0.182601119 Fg/m^3	0.40	38, pp. C-2 and C-5
TSP-2 R3760E1 MDCE-1	Beryllium	(2.8 Fg/filter) ÷ (860.89913 m^3) = 0.003252413 Fg/m^3	0.20	38, pp. C-3 and C-5
TSP-2 R3760E1 MDCE-1	Copper	(787 Fg/filter) ÷ (860.89913 m^3) = 0.914160524 Fg/m^3	0.40	38, pp. C-3 and C-5
TSP-2 R3760E1 MDCE-1	Lead	(316 Fg/filter) ÷ (860.89913 m^3) = 0.367058101 Fg/m^3	0.40	38, pp. C-3 and C-5
TSP-5 R3760N1 MDCN-1	Beryllium	(1.0 Fg/filter) ÷ (707.6993 m^3) = 0.001413029 Fg/m^3	0.20	38, pp. C-4 and C-5
TSP-5 R3760N1 MDCN-1	Copper	(466 Fg/filter) ÷ (707.6993 m^3) = 0.658471754 Fg/m^3	0.40	38, pp. C-4 and C-5
TSP-5 R3760N1 MDCN-1	Lead	(144 Fg/filter) ÷ (707.6993 m^3) = 0.20347625 Fg/m^3	0.40	38, pp. C-4 and C-5

Notes:
NA Not available
Fg/m^3 Microgram per cubic meter

<u>Chemical Analysis - AIRSData:</u>

Additional air sampling data for the slag pile was obtained from the U.S. Environmental Protection Agency's (EPA) Aerometric Information Retrieval System Data (AIRSData). The AIRSData provides analysis of air samples collected from three of the four air monitors described above and shown on Figure 5. They include one located on the PGW property, one located on Tioga Marine Terminal property (Castor and Delaware Avenues), and one located on the PWD property (NEWPCP Lagoon) (Ref. 46, p. 2). The samples were collected through high-volume sampling, and the samplers were located 15, 18, and 25 meters above sea level (Refs. 48, p. 1; 49, p. 1; 50, p. 1) The method for lead analysis for all samples was atomic absorption with a detection limit of 0.002 Fg/m^3 and all samples were collected over a 24-hour period (Refs. 53; 47, pp. 1, 3, 5; 48, pp. 1, 3, 5; 49, pp. 1, 3, 5; 50, pp. 1, 3, 5). The AIRSData provides quarterly averages for each air monitoring station (Ref. 46, Appendix A). According to the AIRSData, lead concentrations exceeded limits in an air sample collected from air monitor 421010449-1, located at Castor and Delaware Avenues on the Tioga Marine Terminal property in 1998 (Refs. 46, Appendix A, p. A-3 and Appendix B, p. B-2). Lead concentrations exceeded limits in air samples collected from the same air monitor in 1995 and 1996; however, the FSRC was operating during those years and may have contributed to the lead detections (Ref. 6, p. 1). The only significant sources of lead air emissions identified near the air monitoring station are the FSRC and FSP (Ref. 5, pp. 2 - 4). Therefore, FSP is the probable source of the lead in 1998, when FSRC was no longer operating.

The AIRSData, Air Quality Subsystem Raw Data Report (data report) was obtained from the Philadelphia Air Management Services. That data report was reviewed to determine whether releases occurred from the FSP during the period of October 1997 (after the closing of the FSRC) through March 1999. The data report indicates that releases of lead occurred from the FSP after the closing of FSRC. The samples were collected through high-volume sampling. The method for lead analysis for all samples was atomic absorption with a detection limit of 0.002 Fg/m^3 and all samples were collected over a 24-hour period (Refs. 53; 47, pp. 1, 3, 5; 48, pp. 1, 3, 5; 49, pp. 1, 3, 5; 50, pp. 1, 3, 5). A summary of the releases is provided in the sections below.

Background and Release Concentrations

The AIRSData data report was also reviewed to determine whether releases occurred from the FSP during the period of October 1997 (after the closing of the FSRC) through March 1999. Data were reviewed for four air monitoring stations, including the three stations discussed above and one located at Richmond Street and Wheatsheaf Lane (Figure 5). The data report provided concentrations of lead detected in air samples for each day that a sample was collected. The wind direction the day that the sample was collected was not provided in the data report (Refs. 47 - 50). The direction of the wind is needed to identify an appropriate background sample location and determine whether an observed release to air occurred from the slag pile. Surface weather data were used to determine the direction of the wind on the days that air samples were collected (Reference 51). A large number of air samples was collected for the time period between October 1997 through March 1999, so one of the air monitoring stations was selected as background, the one located at Richmond Street and Wheatsheaf Lane. This station was selected as background because it is the farthest from the slag pile and, therefore, outside of the influence of the site. The other air monitoring stations are located within several hundred feet of the slag pile. Because of their proximity to the slag pile, they were considered to be inappropriate background locations. The surface weather data were reviewed from the Philadelphia International Airport, the nearest weather station recording the wind direction. The days on which the wind blew from the north to the south were identified. Those days were identified because the air monitoring station located at Richmond Street and Wheatsheaf Lane would be considered a background location at that time because of the wind direction. The data report was reviewed to identify days on which

A copy of the *Figure 5* is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

samples qualified as an observed release to air using the Richmond Street and Wheatsheaf Lane air monitoring station as background and the wind was blowing from the north to the south. Table 19 below summarizes the location and height of the background and release samples.

TABLE 23
BACKGROUND AND RELEASE AIR SAMPLES

Sample Identification	Elevation Mean Sea Level	Probe Height	Reference
Richmond Street and Wheatsheaf Lane (Background)	Not listed	8 meters	47, pp. 1, 3, 5
Castor and Carbon Streets, PGW	15 meters	2 meters	48, pp. 1, 3
Castor and Delaware Avenues, Tioga Marine Terminal (TMT)	18 meters	2 meters	49, pp. 1, 3, 5
Philadelphia Water Department, NEWPCP Lagoon Area (NEWPCP)	25 meters	3 meters	50, pp. 1, 3, 5

Tables 20 through 22 summarize the background and release concentrations and the direction of the wind for the PGW, Tioga Marine Terminal, and NEWPCP, respectively. The samples were collected through high-volume sampling. The method for lead analysis for all samples was atomic absorption with a detection limit of 0.002 Fg/m^3 (Refs. 53; 47, pp. 1, 3, 5; 48, pp. 1, 3, 5; 49, pp. 1, 3, 5; and 50, pp. 1, 3, 5). The direction of the wind was obtained from the NOAA National Climatic Data Center surface weather data. The surface weather data provide the direction from which the wind is blowing in tens of degrees (2 digits) clockwise from true north (Ref. 51, p. 19). If the wind is blowing from the west to the east, the wind direction is recorded as 36; from the north to the south, the wind direction is recorded as 09; from the east to the west, the wind direction is recorded as 18; and from the south to the north, the wind direction is recorded as 27. The table below summarizes the observed releases to the air monitor located on Castor and Carbon Streets on the PGW property for the time period including October 1997 through March 1999.

TABLE 24
BACKGROUND AND RELEASE AIR SAMPLE - PGW PROPERTY
CONCENTRATIONS OF LEAD

Release Sample ID	Release Conc. Lead (Fg/m^3)	Background Lead Conc. (Fg/m^3)	Date	Wind Direction (blowing from) (tens of degrees)	Reference
PGW	0.08	0.01	10/25/97	West (01)	47, p. 1; 48, p. 1; 51, p. 1
PGW	0.04	0.01	11/30/97	West (04)	47, p. 2; 48, p. 2; 51, p. 2
PGW	0.09	0.01	5/17/98	North (08)	47, p. 3; 48, p. 3; 51, p. 8
PGW	0.13	0.04	6/10/98	Northeast (15)	47, p. 3; 48, p. 3; 51, p. 9
PGW	0.36	0.02	6/22/98	North (10)	47, p. 3; 48, p. 3; 51, p. 9
PGW	0.03	0.00	8/09/98	Northeast (14)	47, p. 3; 48, p. 3; 51, p. 11
PGW	0.53	0.01	8/27/98	West (05)	47, p. 4; 48, p. 3; 51, p. 11
PGW	0.24	0.06	9/02/98	East (18)	47, p. 3; 48, p. 3; 51, p. 12
PGW	0.57	0.04	10/26/98	North (08)	47, p. 3; 48, p. 3; 51, p. 13
PGW	0.28	0.07	2/17/99	West (05)	47, p. 5; 48, p. 5; 51, p. 17

Notes:

Conc.	Concentration
ID	Identification
PGW	Philadelphia Gas Works
Fg/m^3	microgram per cubic meter

TABLE 25
BACKGROUND AND RELEASE AIR SAMPLE - TIOGA MARINE TERMINAL
CONCENTRATIONS OF LEAD

Release Sample ID	Release Conc. Lead (Fg/m^3)	Background Conc. Lead (Fg/m^3)	Date	Wind Direction (blowing from) (tens of degrees)	Reference
TMT	0.26	0.05	10/13/97	Northeast (16)	47, p. 1; 49, p. 1; 51, p. 1
TMT	0.09	0.01	10/25/97	West (01)	47, p. 1; 49, p. 1; 51, p. 1
TMT	0.14	0.03	11/06/97	Northwest (05)	47, p. 1; 49, p. 1; 51, p. 2
TMT	0.52	0.01	11/30/97	Northwest (04)	47, p. 2; 49, p. 2; 51, p. 2
TMT	0.33	0.04	02/04/98	Northwest (05)	47, p. 3; 49, p. 3; 51, p. 5
TMT	0.09	0.02	03/18/98	North (08)	47, p. 3; 49, p. 3; 51, p. 6
TMT	0.08	0.01	05/17/98	North (08)	47, p. 3; 49, p. 3; 51, p. 8
TMT	0.07	0.02	06/22/98	North (10)	47, p. 3; 49, p. 3; 51, p. 9
TMT	0.05	0.01	08/27/98	North (05)	47, p. 4; 49, p. 4; 51, p. 12
TMT	0.12	0.04	10/26/98	North (08)	47, p. 3; 49, p. 3; 51, p. 13
TMT	0.43	0.06	11/25/98	Northeast (13)	47, p. 3; 49, p. 3; 51, p. 14

Notes:
Conc. Concentration
ID Identification
TMT Tioga Marine Terminal
Fg/m^3 microgram per cubic meter

TABLE 26
BACKGROUND AND RELEASE AIR SAMPLE
PHILADELPHIA WATER DEPARTMENT (NEWPCP)
CONCENTRATIONS OF LEAD

Release Sample ID	Release Conc. Lead (Fg/m^3)	Background Conc Lead (Fg/m^3)	Date	Wind Direction (blowing from) (tens of degrees)	Reference
NEWPCP	0.45	0.09	10/07/97	North (09)	47, p. 1; 50, p. 1; 51, p. 1
NEWPCP	0.12	0.03	11/06/97	Northwest (05)	47, p. 1; 50, p. 1; 51, p. 2
NEWPCP	0.95	0.04	06/10/98	Northeast (15)	47, p. 3; 50, p. 3; 51, p. 9
NEWPCP	0.22	0.01	08/27/98	Northwest (05)	47, p. 4; 50, p. 4; 51, p. 11

Notes:
Conc. Concentration
ID Identification
NEWPCP Northeast Water Pollution Control Plant
Fg/m^3 microgram per cubic meter

Level I Sample

An observed release to air of beryllium, copper, and lead is documented above within the 0- to 1/4-mile radii. A Level I sample is any concentration of beryllium, copper, or lead that exceeds the cancer risk screening concentration for air. Summarized below are samples that exceed the cancer risk screening concentration for beryllium. These samples meet the Level I criteria (Ref. 1, Table 6-14).

Sample ID: TSP-2 (R3760E1, MDCE-1) (Ref. 38, Appendix C, p. C-3 and Appendix D, p. D-2)

Reference for Benchmarks: Cancer Risk Screen Concentration (Ref. 2, p. B-24)

TABLE 27
CONCENTRATIONS FOR SAMPLE TSP-2

Hazardous Substance	Sample ID	Hazardous Substance Concentration (Fg/m^3)	Benchmark Concentration (Fg/m^3)	Level	Reference
Beryllium	TSP-2 R3760E1 MDCE-1	3.23×10^{-3}	1.0×10^{-6}	I	1, Table 6-14; 2, p. B-24; 39, p. 10

Notes
ID Identification
Fg/m^3 microgram per cubic meter

Sample ID: TSP-3 (R3760S1, MDCS-1) (Ref. 38, Appendix C, p. C-2 and Appendix D, p. D-2).

Reference for Benchmarks: Cancer Risk Screen Concentration (Refs. 1, p. 51661; 2, p. B-24)

TABLE 28
CONCENTRATIONS FOR SAMPLE TSP-3

Hazardous Substance	Sample ID	Hazardous Substance Concentration (Fg/m^3)	Benchmark Concentration (Fg/m^3)	Level	Reference
Beryllium	TSP-3 R3760S1 MDCS-1	1.50×10^{-3}	1.0×10^{-6}	I	1, Table 6-14; 2, p. B-24; 38, Appendix C, p. C-2 and Appendix D, p. D-2

Notes:
ID Identification
Fg/m^3 microgram per cubic meter

<u>Attribution</u>:

As documented in Table 1, the slag pile or grit in the slag pile contains beryllium, copper, and lead. The air monitors documenting the observed release to air in January 2000 from the slag pile were located around all four sides of the slag pile (Figure 4) (Refs. 37, p. 4; 39, pp. 1 - 4). No significant sources of beryllium, copper, and lead have been identified within the area of the air monitors other than the FSP and FSRC (Figure 4). FSRC was not operating in January 2000 when the air samples were collected: FSRC ceased operations in September 1997 (Ref. 6, p. 1). Ambient beryllium, copper, and lead levels continued to meet the criteria for documenting an observed release to air after FSRC ceased operations, as documented in Tables 22, 24, 25, and 26. This indicates that the slag pile is a source of beryllium, copper, and lead air emissions. Wastes remaining on the FSRC may contain beryllium, copper, and lead. The background air samples provide a measure of the potential air emissions from those wastes. Concentrations of beryllium, copper, and lead in air samples collected down wind from the slag pile are higher then up wind of the slag pile as documented in Table 22. Additionally, a removal action was completed at the FSRC (Ref. 65). Significant sources of beryllium, copper, and lead are not expected to remain on FSRC.

Dust from the slag pile was observed to be blowing around the property on which the pile was located (Ref. 66, p. 6). During the emergency response action, airborne releases of slag were observed when winds exceeded 5 miles per hour (mph). Winds between 10 to 15 mph were observed carrying large black dust clouds of material off the slag pile to the northeast (Ref. 15, p. 2).

Tioga Marine Terminal employees complained to the EPA OSC of airborne black grit (slag) in their coffee and water. The employees stated that when trucks used their brakes, black grit was blown into the air from the road surface (Ref. 5, p. 2).

Also, during a snow storm, the EPA OSC observed black grit along Delaware Avenue. When the wind blew, slag was observed to enter the air (Ref. 5, p. 2).

In addition to observations made of grit from the slag pile entering the air, grit was observed on the Tioga Marine Terminal property and on the inactive railroad track that parallels Delaware Avenue south of the slag pile (Ref. 18, p. 2). The analytical results from the soil samples collected from the area of the inactive railroad track revealed significant concentrations of beryllium, copper, and lead (Refs. 18, pp. 1 -4; 19, Appendix B, pp. 1 to 4 and Appendix C, pp. C-1 to C-20, Appendix D, pp. D-1 and D-2). The analytical results from the soil samples collected from the area around the slag pile revealed significant concentrations of beryllium, copper, and lead (Refs. 4, p. 5, Attachment 5, and Attachment 6, pp. A-6-13, A-6-14, and A-6-15 and 22). The presence of grit and beryllium, copper, and lead in soil surrounding the slag pile and observations of grit being carried by wind indicate that the air borne grit contains beryllium, copper, and lead. The FSRC may also have been a source of the beryllium, copper, and lead in soil. However, observations of grit being carried by air indicate that the slag pile is also a source of those contaminants.

No significant sources of beryllium, copper, and lead contamination to air, other than FSRC and FSP, have been identified within a 0.25-mile radius of the slag pile (Ref. 5, pp. 2, 3, and 4). Lead is a naturally occurring metal found in small amounts in the earth’s crust (Ref. 44, p. 2). Human activities have spread lead and substances that contain lead to all parts of the environment (Ref. 44, p. 3). Sources of lead in the environment and air include the former use of “leaded” gasoline; burning fuel (such as coal or oil); industrial processes; burning solid waste; weathering and chipping of lead-based paint from buildings and other structures; municipal and hazardous waste dump sites; mining wastes in sandlots, driveways, and roadbeds; iron and steel industries; lead producers; mining piles; lead-acid-battery manufacturing; and non-ferrous foundries (Ref. 44, pp. 3, 4, 5, 8, 9, and 10). None of those sources, other than FSRC, has been identified within a 0.25-mile radius of the slag pile (Ref. 5, pp. 2 - 4). The FSRC was not in operation when the air samples documenting an observed release to air were collected (Refs. 6, p. 1; 38, Appendix D, p. D-2). FSRC, exhaust emissions, and fuel burning may have contributed to the concentrations of lead detected in the air release samples. However, the background air sample is expected to represent these background lead emissions. Additionally, lead has been documented in the slag pile waste samples (see Section 2.4.1), and the slag pile was not covered when the release of lead to air was documented by chemical analysis (Refs. 5, pp. 2 and 4; 38, Appendix D, p. D-2). Particulates from the slag pile have been observed to release to air (Ref. 5, p. 2) and the particulates are expected to contain lead (Ref. 44, pp. 6 and 7).

Beryllium occurs as a chemical component of certain rocks, coal and oil, soil, and volcanic dust. Beryllium is converted into alloys (mixtures of metals). Most of these alloys are used in making electrical and electronic parts or as construction materials for machinery and molds for plastics (Ref. 45, p. 2). The most common air emission of beryllium comes from the burning of coal and oil, which increases beryllium levels in air (Ref. 45, pp. 3 and 4). Less common sources of beryllium air emissions include emissions from ore processing, metal fabrication, beryllium oxide production and use, and municipal waste combustion (Ref. 45, pp. 4 and 5). FSRC is known to be a former processor of beryllium (Ref. 45, pp. 6 and 7) and to process scrap electrical and telecommunications waste (Ref. 17, p. 1). Other than the FSRC and the burning of coal and oil, no potential sources of beryllium contamination have been identified within a 0.25-mile radius of the site (Ref. 5, pp. 2, 3, and 4). The FSRC was not in operation when the air samples documenting an observed release to air were collected (Refs. 6, p. 1; 38, Appendix D, p. D-2). Therefore, FSRC is not expected to be a significant source of beryllium air emissions during the sampling event. Coal and oil may have been burned within a 0.25-mile radius of the slag pile. However, the background sample is expected to represent these background beryllium emissions. Beryllium has been documented in the slag pile waste samples (see Section 2.4.1), and the slag pile was not covered when the release of beryllium to air was documented by chemical analysis (Refs. 5, pp. 2 and 4; 38, Appendix D, p. D-2). Particulates from the slag pile have been observed to release to air (Ref. 5, p. 2) and the particulates are expected to contain beryllium (Ref. 45, pp. 6 and 7).

Philadelphia Air Management Services cited MDC Industries, Inc. for air emission violations for emissions that exceeded the National Ambient Air Quality Standards (Ref. 4, p. 3).

In 1992, air dispersion modeling was conducted for lead and particulate matter less than or equal to 10 microns (PM-10) in the vicinity of FSRC (Ref. 58, p. 1). Air emissions for the slag pile located on MDC were modeled. The air model indicated that the slag pile emitted PM-10 and lead (Ref. 58, pp. 7, 16, 21, 26, 32, and B-14 - B-27).

<u>Hazardous Substances in the Released</u>:

beryllium
copper
lead

Air Observed Release Factor Value: 550

6.2 WASTE CHARACTERISTICS

6.2.1 TOXICITY/MOBILITY

The table below lists all hazardous substances for which an observed release to the air pathway has been documented. Included in the table for each hazardous substance are the toxicity factor value and particulate mobility factor value used to determine the combined toxicity/mobility factor value. Because an observed release of beryllium, copper, and lead is documented to the air pathway, a mobility factor value of 0.02 is assigned to both hazardous substances (Ref. 1, Section 6.2.1.2).

TABLE 29
AIR TOXICITY/MOBILITY FACTOR VALUES

Hazardous Substance	Toxicity Factor Value	Mobility Factor Value	Toxicity/Mobility Factor Value (Table 6-13)	Reference
Beryllium	10,000	0.02	200	2, p. B-3; 1, Section 6.2.1.3
Copper	***	0.02	***	2, p. B-6; 1, Section 6.2.1.3
Lead	10,000	0.02	200	2, p. B-13, 1, Section 6.2.1.3

Notes:
*** Toxicity data is not available in Reference 1.

Toxicity/Mobility Factor Value: 200

6.2.2 HAZARDOUS WASTE QUANTITY

The hazardous waste quantity value for the slag pile is summarized in the table below and documented in Section 2.4.2.1.5.

TABLE 30
AIR - SOURCE HAZARDOUS WASTE QUANTITY VALUE

Source Number	Source Name	Source HWQ Value	Are Source Hazardous Constituent Quantity Data Complete? (Yes/No)
1	slag pile	27,200	No

Notes:
HWQ Hazardous Waste Quantity

From Reference 1, Table 2-6, the source HWQ factor value (10,000) is obtained.

Source HWQ Value: 10,000

6.2.3 WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

The waste characteristics factor category value is obtained by multiplying the toxicity/mobility factor value (200) by the HWQ factor value (10,000), yielding a product of 2×10^6 and obtaining a waste characteristics factor category value from Reference 1, Table 2-7.

200 (toxicity/mobility factor value) × 10,000 (HWQ value) = 2×10^6

HWQ Factor Value: 10,000
Waste Characteristics Factor Category Value: 32

6.3 TARGETS

The Level I and II air targets are summarized in the sections below.

Level I Distance Categories

Two air samples collected in January 2000 document an observed release to the air migration pathway and exceed a health-based benchmark (see Tables 27 and 28). The two samples are within the 0- to 0.25-mile radii of the slag pile (Figure 4) (Ref. 37, p. 4). A summary of those samples is listed below.

Sample ID: TSP-3 (MDCS-1, R3760S1)
Location: West of the slag pile on the PGW property
Reference: 38, Appendix D, p. D-2; 5, Figure 1, p. 2

Sample ID: TSP-2 (MDCE-1, R3760E1)
Location: On the Tioga Marine Terminal property, on the southeastern side of Delaware Avenue
Reference: 38, Appendix D, p. D-2; 5, Figure 1, p. 2

Distance category subject to Level I concentration: 0.25 (0 to 0.25 mile)

Level II Distance Categories

Three air samples collected in January 2000 that document an observed release to the air migration pathway are within the 0- to 0.25-mile radii of the slag pile (Figure 4) (Ref. 37, p. 4). The samples contain concentrations of copper and lead and one concentration of beryllium that do not exceed a health-based benchmark but meet the criteria for an observed release. A summary of those samples is listed below.

Sample ID: TSP-3 (MDCS-1, R3760S1)
Location: West of the slag pile on the PGW property
Reference: 38, Appendix D, p. D-2; 5, Figure 1, p. 2

Sample ID: TSP-2 (MDCE-1, R3760E1)
Location: On the Tioga Marine Terminal property, on the southeastern side of Delaware Avenue
Reference: 38, Appendix D, p. D-2; 5, Figure 1, p. 2

Sample ID: TSP-5 (MDCN-1, R3760N1)
Location: PWD, in the wetland area near Delaware Avenue
Reference: 38, Appendix D, p. D-2; 5, Figure 1, p. 2

Distance category subject to Level II concentration: 0.25 (0 to 0.25 mile)

6.3.1 NEAREST INDIVIDUAL FACTOR

The nearest individual factor values are determined in the sections below.

Nearest Individual - Level I Concentration

The PWD, PGW, the Tioga Marine Terminal, and Philadelphia Department of Streets are located within the 0- to 0.25-mile radii of the slag pile (Ref. 5, Figure 1, p. 3). The worker populations are, therefore, subject to Level I concentrations.

Residence, building, or area subject to Level I concentrations: PWD, PGW, the Tioga Marine Terminal, and the Philadelphia Department of Streets
Source: slag pile (Source 1)
Distance from the nearest source in miles: within 0 to 0.25 mile
Reference: 5, Figure 1, p. 3
Because workers are subject to Level I concentrations, a nearest individual factor value of 50 is assigned (Ref. 1, Table 6-16).

Nearest Individual Factor Value: 50

6.3.2 POPULATION

6.3.2.2 LEVEL I CONCENTRATIONS

The table below summarizes the population in each distance category exposed to Level I concentrations.

TABLE 31
LEVEL I POPULATION

Distance Category (mile)	Place of Work	Population	Reference
0 to 0.25	Philadelphia Water Department	125	40; 5, Figure 1, p. 3
	Philadelphia Gas Works	125	41; 5, Figure 1, p. 3
	Tioga Marine Terminal	40	42; 5, Figure 1, p. 3
	Philadelphia Department of Streets	173	43; 5, Figure 1, p. 3

The total population exposed to Level I concentrations is 463. The Level I factor value is the population exposed to Level I concentrations (463), multiplied by 10 (4,630) (Ref. 1, Section 6.3.2.2).

Population Exposed to Level I Concentrations: 463
Level I Concentration Factor Value: 4,630

6.3.2.3 LEVEL II CONCENTRATIONS

All Level II populations are subject to Level I concentrations. Therefore, Level II populations are not evaluated (Ref. 1, Section 6.3.2.3).

Level II Concentration Factor Value: 0

6.3.2.4 POTENTIAL CONTAMINATION

The population subject to potential contamination within the 4-mile target distance limit is summarized in the table below. These are the populations not included within the distance categories exposed to Level I and II concentrations but located within the 4-mile target distance limit (Ref. 1, Section 6.3.1.4).

TABLE 32
DISTANCE-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FACTOR FOR AIR PATHWAY

Distance Category (miles)	Population	Population Value (Ref. 1, Table 6-17)	Reference
On a source	0		
Greater than 0 to 0.25	463	Evaluated as Level I	
Greater than 0.25 to 0.50	166	9	54
Greater than 0.50 to 1.0	5,184	83	54
Greater than 1.0 to 2.0	71,393	266	54
Greater than 2.0 to 3.0	155,710	375	54
Greater than 3.0 to 4.0	228,349	229	54

The total distance-weighted population values for the above distance categories is 962. This sum is divided by 10 to yield the population contamination factor value of 96.2.

Distance-weighted Population Subject to Potential Contamination: 962
Potential Contamination Factor Value: 96.2
(Ref. 1, Section 6.3.1.4)

6.3.3 RESOURCES

No commercial agriculture, commercial silviculture, or major or designated recreation areas have been identified within 0.5 mile of the site. The Delaware River is used for recreational activities; however, it is not a major or designated recreation area within 0.5 mile of the site.

Resources Factor Value: 0

6.3.4 SENSITIVE ENVIRONMENTS

6.3.4.1 ACTUAL CONTAMINATION

Sensitive Environments

Sensitive environments identified within the 0.25-mile radius to which an observed release to air has been documented include the wetlands located on the north and northeastern sides of the site and the Delaware River which provides habitat for endangered species and anadromous fishes (Refs. 5, p. 3; 24; 28, p. 3-9; 29, pp. 337 and 340).

The Delaware River is protected for the maintenance and propagation of fish species and fauna that are indigenous to a warm-water habitat. The Delaware River is state protected for the passage, maintenance, and propagation of anadromous and catadromous fishes and other fishes that ascend to flowing waters to complete their life cycle (Ref. 25, pp. 93-6, 93-7, 93-45, 93-48, and 93-49).

The shortnose sturgeon (*Acipenser brevirostrum*), a Federally endangered species, is known to inhabit the Delaware River within the surface-water migration pathway (Ref. 29, pp. 337 and 340). The peregrine falcon (*Falco peregrinus*), a Federally endangered species, and the bald eagle (*Haliaeetus leucocephalus*), a Federally threatened species, hunts and feeds along the Delaware River (Ref. 28, p. 3-9).

TABLE 33
ACTUAL CONTAMINATION OF SENSITIVE ENVIRONMENTS

Sensitive Environment	Distance Category	Reference	Value(s)
State designated area for protection and maintenance of aquatic species	0.25 mile	25, pp. 93-6, 93-7, 93-45, 93-48, and 93-49	5
Anadromous fishes	0.25 mile	25, pp. 93-6, 93-7, 93-45, 93-48, and 93-49	75
Shortnosed sturgeon	0.25 mile	29, pp. 337 and 340	75
Peregrin falcon	0.25 mile	28, p. 3-9	75
bald eagle	0.25 mile	28, p. 3-9	75

Sum of Sensitive Environments Value: 305

Wetlands

The Camden, New Jersey-Pennsylvania National Wetlands Inventory map identifies the site area and an isolated wetland located on the northeastern border of the site as palustrine open-water wetlands (Ref. 24). During the November 2000 site reconnaissance, the site was observed to be covered with a capped slag pile, and the isolated wetland was observed to be dry and vegetated with *Phragmites communis* (Ref. 5, p. 4). The wetland extended from the site to Lewis Avenue along Delaware Avenue and encompasses an area of at least 1 acre (Ref. 5, pp. 3 and 4). The wetland is identified as open-water on the 1972 National Wetlands Inventory map (Refs. 24; 28, p. 1-1). The extent of the wetland may have been incorrectly estimated to encompass the area of the site. Observations made of the site indicate that the site is not a wetland and that the isolated wetland on the northeastern border of the site is a palustrine emergent wetland, rather than an open-water wetland (Refs. 4, p. 3; 5, p. 3; 15, pp. 2 and 4).

TABLE 34
WETLAND SUBJECT TO ACTUAL CONTAMINATION

Distance Category	Wetland Acreage	Reference
0 to 0.25 mile	> 1 acre	5, p. 3; 24

Total Wetland Acreage: >1
Wetland Acreage Value: 25

The sensitive environment actual contamination factor value is the sum of the sensitive environments value (305) and the wetland acreage value (25), which is 330.

Sensitive Environment Actual Contamination Factor Value: 330

6.3.4.2 POTENTIAL CONTAMINATION

The potential contamination of sensitive environments is not evaluated because it will not affect the site score.

Sensitive Environments Potential Contamination Factor Value: 0